PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 63 JULY, 1932 NO. 7

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Brain Teasers

Conducted by

Benjamin Eisner

On accepting the invitation and assuming the honor to be "guess conductor" of this column of mental temptation, we are amazed at the volume of correspondence and interest fostered by the problems which have appeared here. Monkeys, shovels, timekeepers, coconuts, graduates; midnight oil, stop watches; pencil pushing; figures, figures, figures. Solutions come in from Maine to California. But still we wait for a solution to last month's second problem. The answer is 142,857 but why that number is and any other number is not the correct one is a mystery at present unfathomable to us. If you know, don't hide your light under a bushel.

Our solution to Mr. Darby's sphere fitter's problem which also appeared last month, is 3.2 inches diameter, tight fit. If you cut off one corner of the box with a plane perpendicular to the line connecting the center of the box with the corner, and the plane tangent to the sphere, you get a pyramid. Then just fit the small sphere into the pyramid. Patience and perseverance result in the answer.

G. D. Houtman, bridge engineer, Media, Pa. arrived at the correct result by two separate routes. First, he appreciated that the corner of the box into which the small ball is to be fitted is the same one in which the large ball already fits. By proportion, the diameter of the small ball bears the same ratio to the diameter of the large, as the distances from the corner of the box to the near and far side of the large ball, bear to each other. Second, he saw that the corner could be filled with a succession of balls whose diameters decreased in a constant ratio. Knowing the distance from the large ball to the corner of the box, he solved for the first term of an infinite series, x plus x squared plus x cubed, etc. where x is the ratio of diameters *and also the diameter required.*

This month, the problem is dedicated to Independence Day, and is entitled,

The Old Flag Pole

Once upon a time, an one hundred foot high flag pole was erected on ground which sloped five feet vertically in one hundred feet horizontally. To protect the plantings around the base of the pole, a neat fence six feet high and twenty-five feet in diameter was installed around the pole as center. When no one could see him, a mathematical vandal, who was also somewhat of a steeple-jack, cut the pole in two, leaving the upper portion hanging by the proverbial thread. Nicely calculated, the upper portion of the pole fell exactly downhill, just grazing the top of the fence and just touching the ground. How high was the top of that portion of the pole left standing erect?

Now is the time for all patriotic etc. to come to the aid of their flag.

BENJAMIN EISNER

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For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 61.

PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 63 July, 1932 No. 7

A Durable Asphalt Road for $4,500 a Mile

By K. M. Banks

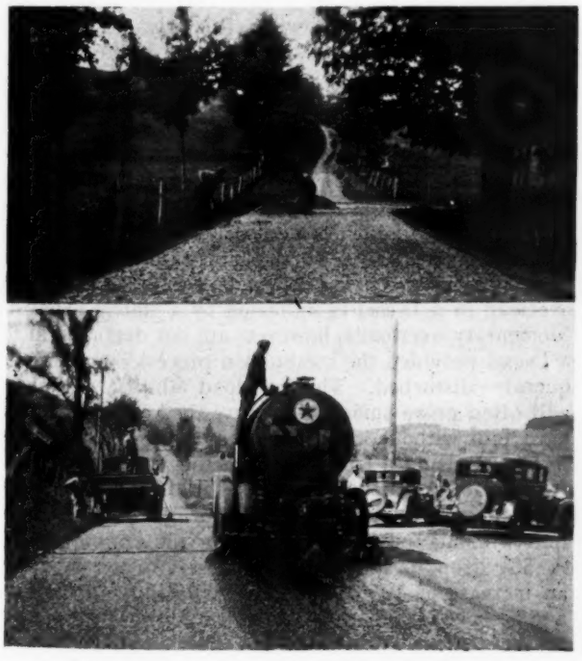
The Texas Company

THE farmers in the north-east corner of Rensselaer County, New York, are engaged largely in milk production and must transport the milk to creamery or railroad every day. This is done almost entirely by one-ton to six-ton automobile trucks, the total load often reaching ten tons. Prior to 1930 most of this hauling was done over gravel roads, which were apt to break up each winter or spring, and a beginning has been made of hard-surfacing these roads.

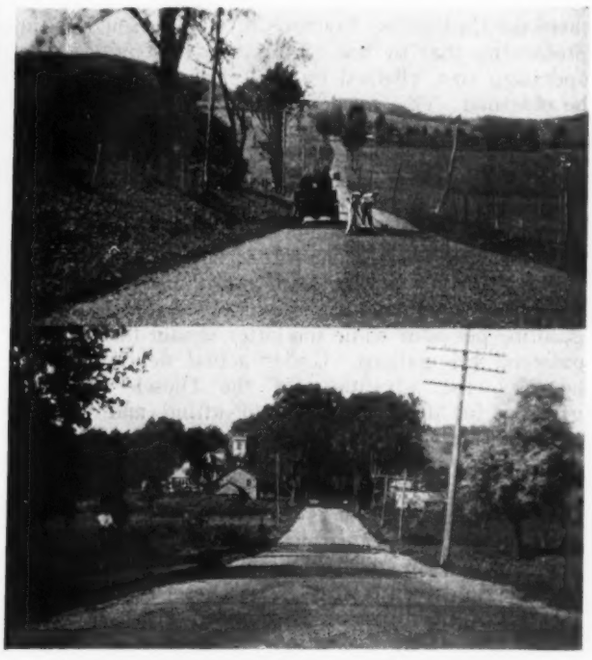
One of these hard-surfacing jobs was a 5½-mile stretch between the villages of Buskirk and Hoosick Falls, over which five to six hundred 40-quart cans of milk are hauled daily from creamery to railroad, after having been brought in by the farmers, much of it over the same road. The town of Hoosick decided to surface as much of these roads as possible with the funds available, and selected a surface-mix type, to be placed on the old gravel road as a base. It was estimated that this would cost about $5,000 a mile, but on the completion of the project the cost was found to have been ten per cent less than this, or about one-third the cost of penetration macadam. This type of road, although relatively inexpensive, has proved to be durable and smooth riding.

The old gravel road that acted as a base for the new surface was of the traffic-bound type. In some sections old laid-up Telford type of base had been laid several decades ago and was still in good condition. Where the road was narrow, the base was widened to sixteen feet, not including the shoulder. This base was graded, dragged and rolled, so that the low places were filled and the high spots removed, and an application made of one-third gallon per square yard of Texaco No. 45 surfacing material, which contains approximately 50% asphalt. This prime coat penetrated and sealed the foundation, serving to prevent water from rising into the wearing surface, or loose, dusty material from rising into the top course during the mixing operation.

After this priming application had been allowed



Top—First stone course being shaped up previous to the initial application of asphalt. Bottom—Applying the seal coat.



Top—Brooming in key stone after applying seal coat. Bottom—Completed road near Buskirk, N. Y.

to set several weeks, a course of No. 2 stone (New York State specifications) was laid to a depth of 2½ inches over the entire width of the road, less one foot on each side, to which was applied ½ gallon to the square yard of Texaco asphalt cut-back material "H," which is a rapidly drying liquid asphaltic product which permits proper mixing with the mineral aggregate before setting up and reverting to an asphalt cement. As soon as the asphalt distributor had passed over the road, a spring-tooth harrow was dragged over the surface. The harrowing did not leave a stone unturned but changed the position of the stone particles so that all would receive a coating of asphalt on the succeeding trip of the distributor. When the harrow had been dragged over the section under construction three or four times and all stones had been well coated, the distributor was passed over the section a second time, pouring four-tenths of a gallon per square yard, and this was again harrowed.

It was considered unnecessary to use a power grader to bring the mixed material to an even contour, since it had already reached this stage through the constant use of the harrow. A ten ton roller was then passed over the road until a smooth, compact surface was obtained. An eighteen foot straight edge was used to detect any depressions or high spots, but these appeared to be very infrequent, since the level and crown of the stone had not been disturbed during the mixing process. Any depressions found were filled with mixed material and rolled, bringing the surface to the proper contour. The resulting road was hard and compact, with only enough crown to take care of all necessary drainage.

At this stage of the work, the road was allowed to stand for several weeks; and a new section was similarly constructed and allowed to stand. After the standing period had elapsed a seal coat was applied consisting of four-tenths of a gallon per square yard of Texaco special macadam binder, which contains approximately 70% of asphalt and is sufficiently heavy to adequately fill the voids of the bottom stone course and at the same time will hold the key stone in place. This makes the pavement permanently waterproof, and leaves enough of the stone showing to produce a non-skid surface, which is very important on the grades of the New York State hills. To help this non-skid surface, about twenty-five pounds per square yard of No. 1 stone (New York State specifications) was broomed over the entire surface, acting as key stone, filling whatever voids were left to be filled.

The road was constructed in sections, each sufficiently long to take one 1,200-gallon distributor load of material, a distance of approximately four hundred feet, which, weather permitting, was completed in one day.

Economy of Using Diesel Engines for Tractors and Trucks

During the past five years study and investigations have been made with a view to developing a Diesel engine that can be used advantageously in tractors, trucks and for similar service. Many commercial institutions have spent considerable sums in operating research laboratories for solving this problem, among them the Caterpillar Tractor Co. The reason was the probability that by use of this type of engine lower operating cost, effected by high fuel economy, could be obtained. This seemed possible because this type of engine consumes cheaper fuels more economically.

In this country Diesel fuels are generally available at prices ranging from 4 to 7 cents a gallon, while gasoline (for agricultural purposes) costs 14 to 16 cents. Comparisons made between "Caterpillar" gasoline and Diesel tractors, each pulling a normal full load under similar load conditions, showed that the former consumed approximately seven gallons of gasoline per hour while the latter should theoretically consume 4½ gallons. Under actual field operation, however, the advantage of the Diesel was even greater, for during periods of idling and reduced loads the rate of gasoline consumption on a horsepower basis is increased but the rate of Diesel fuel consumption is not appreciably altered. Furthermore, the gasoline carburetor is subject to such varieties of opinion as to proper carburetor setting in field practice, that usually the best economies are not derived in gasoline driven tractors. The Diesel fuel system of the "Caterpillar" tractor is provided with factory adjusted and sealed calibrations, which prohibit tampering by field operators and changes in intended adjustments. Field fuel consumption seldom exceeds four gallons per hour in the Diesel tractor.

The operation of a Diesel engine at reduced loads is well illustrated by an actual instance in harvesting. Normally a "Thirty" gasoline tractor was employed for this work, which required 3.3 gallons of gasoline per hour. A Diesel performing the same harvesting consumed 1.3 gallons of Diesel fuel per hour. The economy of the Diesel when properly designed is inherent at all loads and speeds of the tractor.

Other advantages are claimed for the Diesel tractor, according to C. G. A. Rosen, Diesel engineer of the Caterpillar Tractor Co. "The lugging ability of the Diesel engine is extremely valuable in tractor service. The rated load of a Diesel engine is usually based on conservative experiments, which permits of a margin of overload which can be called into service when needed. Full load is usually determined at a point below which the engine exhaust becomes smoky. An overload in a Diesel is indicated by a smoky exhaust. Momentary overloads, however, are not detrimental to a Diesel provided the combustion process is not subsequently disturbed. The overload ability, however, will often prove sufficient to move the tractor out of a hard pull without killing the engine or without calling for assistance from other tractors.

"The torque curve of a Diesel indicates the ability of the engine to pull the tractor out of a difficult position without appreciably reducing the engine speed. A 5% drop in speed in the Diesel tractor provides an increase of 10% in torque, while in a gas engine a 5% speed drop only provides 2½% increase in torque. In the Diesel a 10% reduction in speed still makes available 12% increase in torque, while in a gas engine the torque increase for the same drop is only 4%."

Street Cleaning and Rubbish Collection Accounts in Akron

AKRON, O., has five motor sweepers for cleaning its streets, four of which cover an average of 18 curb-miles each per day, while one works day and night and averages 36 curb-miles; and each of thirteen patrolmen covers 2 to 2½ curb-miles per day. Seven trucks, each with a driver and seven laborers, collect the sweepings from 4 to 5 curb-miles per day; one truck collects paper from boxes placed at street corners; an Eductor with a crew of three men cleans catch basins; a Ford truck with two men cleans sewer inlets; and two flushers, each with two men, flush the streets.

The collections for the year were totalled as follows:

Operating Costs		
Hired vehicles	none	
Truck driver, wages	$4,080.91	
Truck helpers, wages	3,736.50	
Gasoline for trucks	537.35	
Oil and grease	48.60	
Repair labor, city mechanics	41.15	
Repair parts and labor, purchased	229.57	
Foreman, wages	1,020.00	
Total operating cost		$9,694.08
General Costs		
Interest, insurance, garage charge	$307.92	
Depreciation on trucks Nos. 6 and 7	421.96	
Tire charge	512.55	
Reconditioning trucks	321.64	
Total General cost		$1,464.07
Grand Total, All Costs		$11,158.15

General Data	
Total days operated	307
Total truck hours operated	7,762.5
Total truck trips	4,495
Total truck mileage	18,415.7
Average miles per trip	4.1
Total garbage and refuse collected	4,353 tons
Total ashes and cans collected	4,387 bu.
High number of customers (Sept.)	2,797
Low number of customers (March)	990
Average number of customers	1,895
Average garbage per day	14.1 tons
Average garbage per customer	2.29 tons

NOTE: Daily average tonnage per month varied from 18.3 tons in peak to 11.3 tons in low season.

	Unit Costs		
Items	*Operating*	*General*	*Total*
Per day	$31.58	$4.76	$36.34
Per ton	2.24	.33	2.56
Per customer	5.12	.77	5.89
Per mile	.52	.08	.60

The seven trucks referred to also are used for collecting rubbish. In 1930 they collected 2,295 loads of rubbish, estimated to weigh 5,393 tons, at an average cost of $3.14 per ton, or 53 cts. per cubic yard.

The department receives daily records of each piece

Akron's Street Cleaning and Rubbish Collection Truck. A General Motors truck with body 6 ft. wide, 11 ft. long and one foot high.

of equipment, and combines these in monthly reports, one of work done and another of cost of operation, for each piece. The accompanying table shows, for the month of June, the statistics given in both records for the nine trucks. The records for the flushers give similar information, except that, instead of loads collected, they give loads of water used; and the records for the sweepers do not give the loads collected.

The figures for the operation of the incinerator for the year are given in the following statement:

General Data		
Total garbage and refuse collected by city forces		4,353.0 tons
Total refuse brought in by private parties		76.5 tons
Total amount incinerated		4,429.5 tons
Total days operated	304	
Average garbage and refuse burned per day	14.5 tons	
Operating Costs		
Plant, fireman and labor, wages	$2,256.90	
Plant repair, tools and misc.	347.45	
Furnace fuel	593.75	
Electric light	15.43	
Gas heat for buildings	52.80	
Water for building	56.29	
Office supplies	80.35	
Foreman, wages	1,020.00	
Total operating cost		$4,422.97
General Costs		
Interest charge on plant (6%)	$2,100.00	
Depreciation and maintenance charge on plant (5%)	1,750.00	
Total general cost		$3,850.00
Grand total, all costs		$8,272.97

	Unit Costs		
Items	*Operating*	*General*	*Total*
Per day	$14.55	$12.66	$27.21
Per ton	1.00	.86	1.86
Per customer	2.34	2.03	4.37

Summary of All Costs		
Items	*Operating Cost*	*General Cost*
Collection	$9,694.08	$1,464.07
Incineration	4,422.97	3,850.00
Superintendent	750.00	
Fee collector	1,600.00	
Totals	$16,467.05	$5,314.07
Incinerator repair		
Labor	$769.70	
Material	1,180.29	
Total	$1,949.99	

Refuse Collection by Akron Street Cleaning Department
Month of June

Truck No.	*Capacity*	*No. of Loads Collected*	*No. of Square Yards*	*Gallons of Gas Used*	*Quarts of Oil Used*	*Drivers' Wages*	*Cost of Operation*
12	2½ ton	81	288,951	146	4	$94.50	$125.74
13	2½ ton	91	267,976	183	3	111.75	150.61
14	2½ ton	107	617,841	194	6	156.00	197.61
15	—	4	—	36	1	34.50	42.21
38	2 ton	131	772,427	221	12	161.25	209.40
39	2 ton	139	510,658	133	21	148.50	179.48
65	2½ ton	101	934,163	188	7	143.25	183.75
74	2½ ton	100	742,443	187	8	147.00	187.43
93	¼ ton	78	—	81	—	71.00	88.01

Gasoline purchased in June averaged 21 cts. a gallon, and oil 58 cts. a gallon.

Water Waste Surveys as Drought Insurance

By Edgar K. Wilson
Chief Engineer, The Pitometer Company

THE drought of 1930 and 1931 affected Ashland, Pa., a community of about 7,000 population, as it did hundreds of others in many sections of the country; and on December 27th, 1930, in spite of restrictions placed on the use of water and other precautions to conserve it, the reservoir was practically empty. But on December 27th, 1931, it contained sufficient water to furnish a complete supply for at least four months, although there had been no restrictions on use in 1931 and no addition to the supply, and the drought had continued. The purpose of this article is to explain how this beneficial result was produced.

The water supply for Ashland is taken from several mountain streams, the water being impounded in a reservoir of about 110,000,000 gallons capacity about five miles southeast of the borough. A booster pump is used to maintain pressure at the higher elevations at such times as this falls below about ten pounds.

Previous to 1930 water had been plentiful and there was no particular reason to conserve water in the distribution system and have it waste over the spillway at the reservoir. When the drought made itself felt, restrictions were placed on the use of water and postponed for a short time the complete depletion of the reservoir; but by the end of the year the reservoir was empty and the officials turned to an emergency supply. Also, studying the matter of preventing a recurrence of the shortage, they decided to make a complete audit of the water supplied to the borough by means of a water waste survey, and let a contract for such a survey, which was started in April, 1931, at which time the reservoir was somewhat more than half full.

On April 14th to 15th Pitometer measurements were made of the total flow at the reservoir for twenty-four hours. It was found that the amount supplied for the twenty-four hours was 850,000 gallons, and—a most significant point—the minimum night consumption was at the rate of 715,000 gallons per day, or 84 percent of the total consumption. (Chart 1).

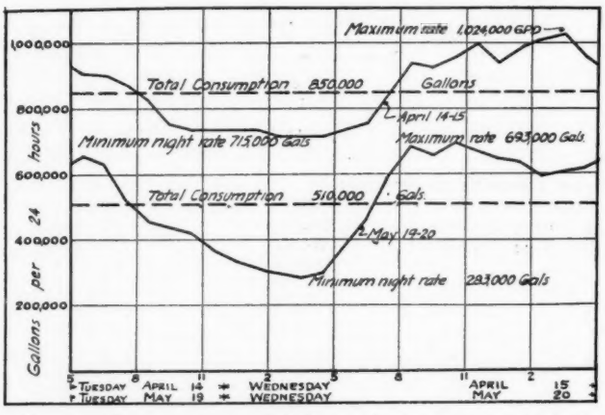


Chart 1—Consumption rates before and after survey and repair of leaks.

The pressure at the time of lowest consumption (on the night of March 25th, preceding the survey) had been 34 pounds per square inch, while during the day it varied between 12 and 20 pounds.

It is not necessary to describe the various steps of the Pitometer survey, since the procedure is quite familiar to most water works officials; and the results only will be given.

Thirty-two underground leaks, which did not appear on the surface of the ground, were located, as follows:

4 Joint leaks wasting	133,000	gallons per day
1 Split pipe wasting	40,000	" " "
3 Abandoned services wasting	75,000	" " "
8 Service leaks wasting	145,000	" " "
14 Gland leaks on valves wasting	75,000	" " "
2 Hyrant leaks wasting	10,000	" " "
Total	478,000	" " "

A remeasurement of the total consumption made on May 19th to 20th, at the close of the survey, with several valve and service leaks still to be repaired, showed a total for twenty-four hours of 510,000 gallons and a minimum night rate of 283,000 gallons per day, or 56 percent of the total consumption. This indicated a reduction of 432,000 gallons per day in the night rate and 29 percent in the ratio between night and day rates. (Chart 1).

At the close of the survey the pressure during the minimum consumption hours of the night had risen to 49 pounds per square inch, an increase of 15 pounds; while the fluctuation during the heaviest consumption period was between 24 and 32 pounds per square inch—an average gain of about 10 pounds.

The gain in pressure at night accounts for a part of the discrepancy between the total of the leaks and the difference between the minimum night rates recorded before and after the survey, while the leaks still unrepaired made up the difference.

During the eight months following the survey, the booster pump was used only one day, instead of practically continuously as had been the case previously. This was largely due to the fact that the reduction in velocity through the five miles of 12" feed main resulted in a corresponding reduction in friction losses. Such gain in head eliminated not only the necessity of pumping at the booster plant but also the need of constructing in the near future a parallel feed main five miles long from the reservoir to the borough.

The principal value of this survey of a gravity fed system may be understood more readily by an analysis of the storage conditions, for which the author is indebted to H. E. Beckwith, of Harrisburg, Pa., under whose direction the survey was made.

The total water available will ordinarily amount to the total storage plus the stream flow. This will not vary in proportion to the amount of storage alone; for example, if the storage should be doubled, the

stream flow would remain the same, and the total supply available therefore would not be doubled.

Reservoir capacity plus stream flow (at its minimum, in times of drought) represent a certain number of days' supply. Assuming no waste at the reservoir spillway, if the consumption is decreased by restriction in use, repair of leaks, or by any other method, then the water available will also be increased. This increase in days' supply is not in proportion to the reduction in consumption, since only the deficiency between the stream flow and the consumption must be made up from the reservoir storage; and a 25 percent decrease may prolong the storage, expressed in days of supply, as much as 50 or 60 percent or even more.

Applying this to the conditions at Ashland, the accompanying mass storage chart (Chart 2) shows the actual conditions during the drought of 1930-31. Starting with a full reservoir at about July 4th, 1930, the level dropped so rapidly that restrictions in the use of water, estimated to save 125,000 gallons per day, were put in force August 1st; with the result that partial relief was obtained and the storage did not fail until December 27th, when the reservoir was practically empty. If there had been no restrictions, the failure would probably have occurred a month earlier; and this month may be considered as the value of the restrictions.

Early in 1931 a Pitometer waste survey was carried on, with the result that the average consumption was reduced, as previously stated, from 810,000 gallons per day to 510,000 gallons per day, or 40 percent. The chart shows the filling of the reservoir during the spring of 1931 to its full capacity about the middle of May. No loss was experienced until about the middle of July, when the storage fell off (but considerably less sharply than in 1930) until the first of the year, when the streams were replenished. During this period no restrictions were placed on the use of water, and yet on December 27th, (at which date of the previous year the reservoir had been practically empty) there was still enough water to last until May 1st, 1932, at the same average rate of depletion.

Since the average precipitation covered by 45 years of records in the vicinity was about 52 inches, the precipitation for 1931, amounting to 32 inches, was not materially greater than that of 1930 of 29.6 inches; and the drought conditions were no less severe in the year of 1931, considering the depletion of the ground water storage.

A line has been added to the chart showing what the effect would have been in 1930 if the leakage had been stopped prior to the drought period of that year. This indicates that, while the actual depletion of the supply varied somewhat from that of 1931, at the end of the year about the same amount of water would have been available; and that the probable period before final depletion would have been the same.

It is clear, therefore, that the added storage, stated in days of supply, would have been five months in 1930 with leaks repaired and without restrictions, instead of the one month obtained by restrictions only. In other words, the value of the water waste survey in days of added supply was five times that of the restriction in the use of water.

A line drawn parallel to the 1930 curve as it would have been with no restrictions in effect, shows that, to obtain the same results as would have been the case with the underground leaks eliminated, a storage of 220,000,000 gallons would have been needed July 1st, 1930. Since this is double the present storage capacity, it may be said that the value of the waste survey was equal to another reservoir.

The three principal results of the survey may therefore be summed up as follows:

Reduction in cost of booster pump operation, amounting to approximately $100 per month.

Reduction in velocity and consequent friction head in the five miles of 12" feed main from the reservoir to the distribution system; eliminating for many years the need for a parallel 12" main five miles long.

The addition (in terms of days' supply of water) of storage capacity equal to that of the present reservoir.

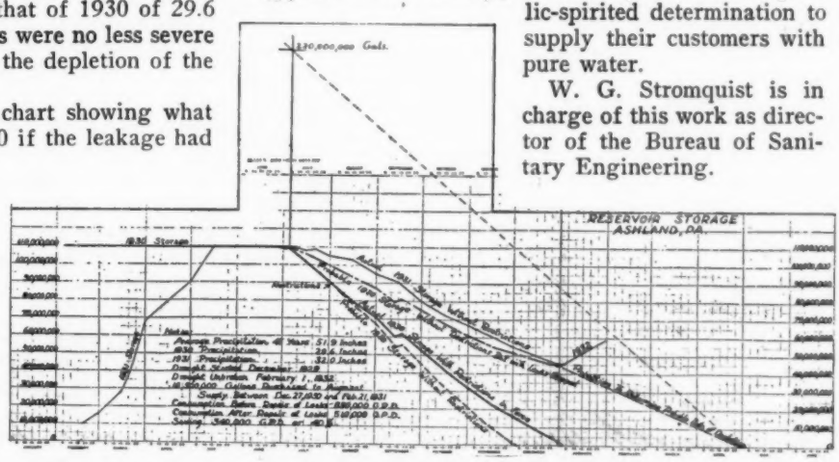


Chart 2—Mass storage chart showing actual and assumed conditions during the drought of 1930-1931.

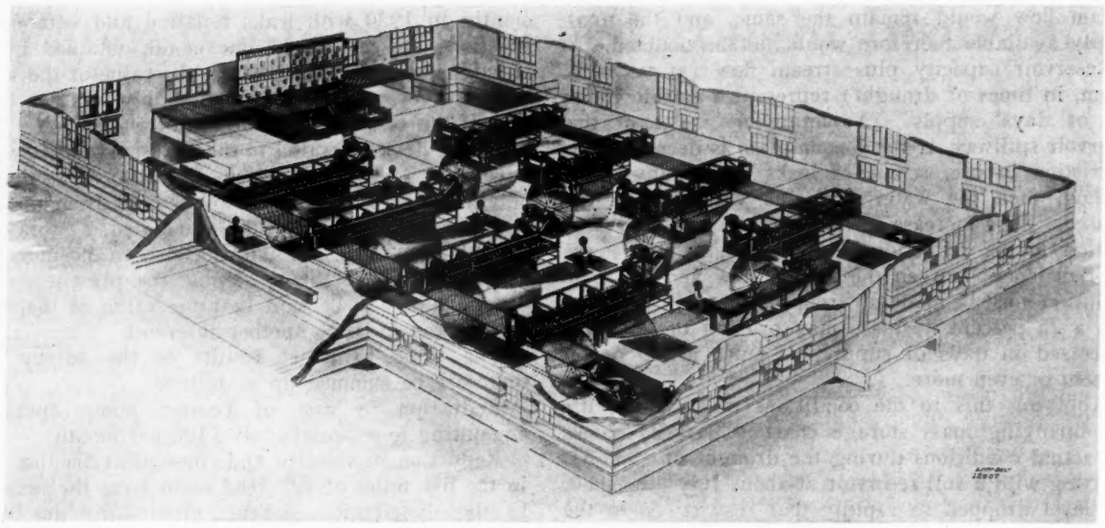
High Scores for Alabama Water Supplies

Jefferson County, Alabama, has within its boundary 35 separate and distinct public water supply systems. Their supervision is one of the tasks of the Bureau of Sanitary Engineering of the Jefferson County Board of Health. Numerous samples of water are taken for bacterial analysis, operating details are checked for accuracy and safety, and suggestions made to operators for improving efficiency. The percentage of samples meeting the United States Public Health Service standards each year have been: 1928, 81.5%; 1929, 86.6%; 1930, 87.3%; 1931, 92.4%.

Ratings of this county's public water supplies for the first four months of 1932 show that all but eight exceeded 90, the rating required by the United States Treasury standard for drinking water. These ratings are based on the number of 10 cc (5 per sample) samples of water in which B.Coli are absent.

Fifteen plants scored 100, ten more than 95, and two between 90 and 95. This record reflects great credit upon the owners and operators of public water supplies in this county; and clearly indicates a public-spirited determination to supply their customers with pure water.

W. G. Stromquist is in charge of this work as director of the Bureau of Sanitary Engineering.



Tark screens as installed in the treatment plant of the Milwaukee Sewage Commission.

Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell
Editor Public Works

II–Fine Screens

NOT all plants have grit chambers and coarse or bar screens, but every plant treating water-carried sewage has as its fundamental feature the separation, more or less nearly complete, of suspended solid matter from the liquid.

This is performed by straining (through screens, filters, soil, etc.) or by sedimentation or possibly by centrifugal force or other physical means; any of which may be aided by the use of chemicals to flocculate, coagulate or otherwise so alter the form of the suspended matter as to facilitate the separation or render it more complete.

Sedimentation is the more common method. Soil straining (irrigation, intermittent sand filtration, etc.) is now seldom used except to supplement other methods of separation. On the other hand, fine screening is sometimes used as a preliminary to sedimentation. More often, however, it is used as the only means of separation where a moderate amount of this meets the requirements.

The fine screens now available remove visible floating solids, and where there is abundant dilution this may meet the requirements. But under the most favorable conditions they seldom remove more than 15 to 20 percent of the total suspended solids, and approximmately 10 per cent with domestic sewage is considered as an average good performance; while sedimentation removes 60 percent or more. It is possible that improvement in construction, conditioning of the sewage, or other, will result in greatly increasing the effectiveness of fine screens in clarifying sewage.

The New York State Department of Health requires that fine screens, if used, "have a net submerged open area, measured below the normal operative level of sewage in the screen chamber, of not less than 2 square feet per million gallons average daily flow of sewage from separate systems and 3 square feet for combined systems. Ample facilities for cleaning screens and for handling the screenings should be provided in all cases." The New Jersey requirements are limited to the provision that mechanical screens shall be in duplicate, the width of slots or openings shall not exceed one-sixteenth of an inch, and specifications must contain guarantees of the efficiency of the screen.

The efficiency of a screen depends upon the fineness of the openings and keeping them clear of solids and the velocity of the sewage through the openings; also upon the physical characteristics of the solids in the sewage when it reaches the screen. As to the last, if the suspended solids have traveled only a short distance they will not be broken up and the screen will remove a larger percentage of them than if the sewage has flowed through several miles of sewer.

The screen openings must be kept open, and this necessitates continuous removal of the solids collecting on the screen. Such removal is effected either by brushing or scraping them off, or by means of water, air or steam forced through the openings from the other side.

Where brushing or scraping is employed slotted plates are much more practicable than wire screens. (A form which is in effect a slotted plate is made by the Link Belt Co. by fastening flat wires with a tapered cross-section on the frame of a drum so as to leave a continuous slot between adjacent wires.) Slots are generally between 1/32" and 3/32" wide

on top and wider on the bottom, and two to four inches long. Wire mesh, when used, has approximately ⅛" openings. The spacing of the slots is controlled by the necessity of maintaining stiffness and strength of the slotted plate.

In general form, the screen may be a flat disc slowly revolving on an inclined axis so that about two-thirds of the area is submerged, the other third rising above the sewage to permit removal of the collected solids. This is the Riensch-Würl type.

Or it may be in the shape of a drum revolving around a horizontal axis, the screening area forming the curved surface of the drum; one end of the drum being closed and the other open; the liquid of the sewage either entering through the screen and leaving through the end or *vice versa*. The former is the more common. This type of screen is made by the Dorr Co., Link Belt Co. and the Chain Belt Co.

Or the screen may consist of a number of panels or wings on the ends of radial arms revolving around a central axis. The Hankin screen is of this type.

Or the screen may have the form of an endless band which passes around a top and bottom drum, half or more of it submerged, the effective face rising slowly above the sewage to permit it to be cleaned—a type made by the Chain Belt Co.

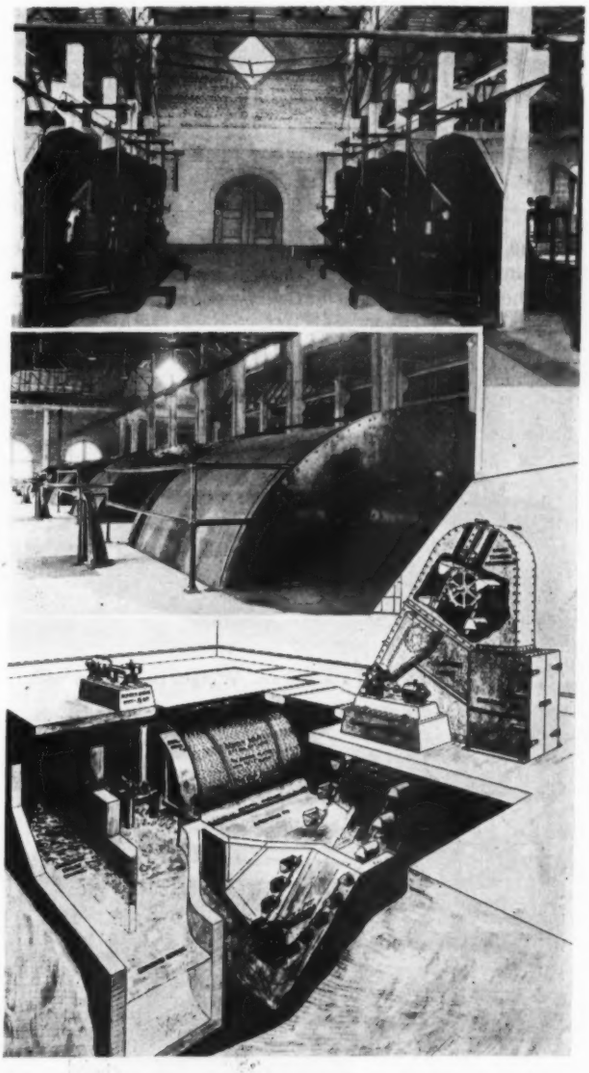
Disc Screen—The Riensch-Würl is believed to be the only kind of disc screen used in this country. It consists of a round, flat plate, ranging from 14 ft. to 30 ft. diameter, revolving around an axis inclined from the vertical by an angle ranging between 10° and 25°. The disc consists of a number of bronze plates fastened to a frame so as to give a continuous smooth surface. These plates contain slots, as many as can be cut without too greatly weakening the plate, generally 1/16 to 1"32 inch wide on top and wider at the botttom. The disc is set so that half or more is immersed in the sewage and the edge of the disc just clears the sewage channel, so that the sewage in flowing along the channel must pass through the slots in the disc, leaving the larger suspended matters on it. As the disc revolves slowly the screenings are removed from the part above the surface by revolving brushes that move over it from the center to the edge and brush the screenings onto a belt, by which they are removed; or into a hopper, which feeds them onto a belt, into a pneumatic conveyor or other means of removal. Such screens are manufactured by the San-Dis Engineering Corporation and the Shevlin Engineering Co.

Drum Screens—The first drum screen used in this country was the Weand screen, installed at Reading, Pa. In this screen the sewage entered at one end and flowed out through the cylindrical sides, which were of fine wire mesh supported on a metal frame. The solids left inside were worked toward one end by an interior spiral flange and there raised by short radial plates and dropped into a chute that projected into this end of the drum. The outward-flow type is, we believe, no longer made.

The next drum screen to appear was the Dorrco. This is inward flow, and the cylindrical screening surface is composed of manganese bronze plates perforated with milled slots 1/16" wide by 2" long, supported by cast iron spiders mounted on a horizontal shaft, which is driven at a speed of 10 to 20 r.p.m. by a motor through silent double worm gear speed reducers. The discharge end of the drum is fitted with a circular bronze seal ring leaving 1/16" or less clearance all around between the screen end and the wall of the screenings pit.

The screen is mounted in a pit into which the raw sewage passes in a direction normal to the axis of the drum. The drum is submerged in the sewage approximately one-third its depth and is so rotated that the surface facing the in-flowing sewage is descending. The sewage enters this side, leaving solids on the exterior, and leaves by the open end. The solids are momentarily retained on the face of the drum by the pressure of the entering sewage; but as the screen revolves, the rising down-stream side lifts the interior sewage several inches above the level of the sewage outside in the screenings pit, and some of it therefore flows out through the slots, throwing into the screening pit the solids adhering to the outer surface of the drum. No mechanical brushes or scrapers are needed to remove the screenings or clean the slots.

The screenings are raised from the pit by a bucket elevator, draining after they rise above the water



Top—Eight screenings elevators and pnuematic screenings ejectors, used with eight 8'x8' fine screens. Center—Five of ten 14'x12' Dorrco fine screens, Los Angeles. Bottom—Phantom view of Dorrco 8'x8' fine screen and accessory equipment.

level, and discharged into a pneumatic ejector or a receptacle of some kind. The elevator above the floor level is completely housed in a steel casing and is driven by its individual motor.

These screens, with 1/16" slots, are said to remove from 12 to 35 cu. ft. of screenings per million gallons, or from 10% to 22% of the total suspended solids; the amount varying with the strength of the sewage and the amount of foreign matters in it. As discharged by the elevator, the screenings contain about 84% to 90% moisture and weigh about 60 lbs. per cubic foot.

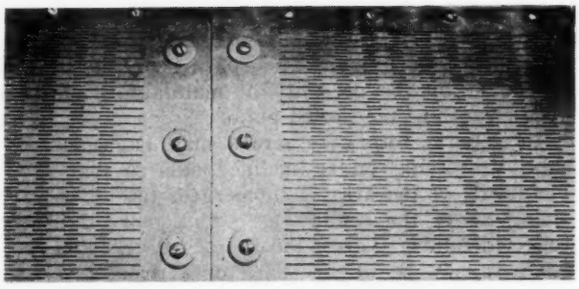
Five 14' diameter by 12' wide screens at the North Hyperion plant of Los Angeles, during eight months' operation, screened an average of 79 m.g.d. and removed an average of 16 cu. ft. of screenings per million gallons (from an average of 10 in March to an average of 23 in August). The maintenance and operation cost an average of $97 a day, or $1.23 per million gallons.

To aid in preliminary designing of a plant for which these screens are considered, the following table is given:

Dorrco Screen Units—Sizes and Capacities

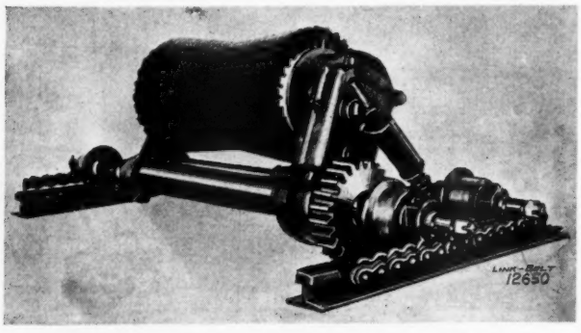
Size of Screen		Submerged	Capacity, M.G.D.		Floor Area		Height of
Dia.	Face Width	Area—Sq. Ft.	1/16" Slots	3/32" Slots	Width	Length	Elevator
3'	3'	14.1	1.6	2.4	10'0"	16'0"	8'8"
5'	4'	31.4	3.5	5.3	11'0"	19'0"	8'8"
6'	4'	37.7	4.2	6.3	12'0"	22'0"	8'8"
6'	6'	56.6	6.2	9.5	15'0"	22'0"	8'8"
8'	8'	100.6	11.1	16.9	18'0"	25'0"	8'8"
14'	12'	263.9	29.0	41.7	22'0"	35'0"	8'8"

The Tark screen, made by the Link Belt Co., uses a drum similar to the Dorrco in general construction, but the drum is almost entirely submerged in the sewage, and the screenings are removed from it by brushes. The plates used are of 3/16" manganese bronze. The ribbon screens (described above) are constructed with phosphor bronze tapered wire or ribbon 3/16" deep and 1/16" thick at the thickest portion, riveted onto brass supporting strips. In both types the slots run parallel to the axis of the drum.

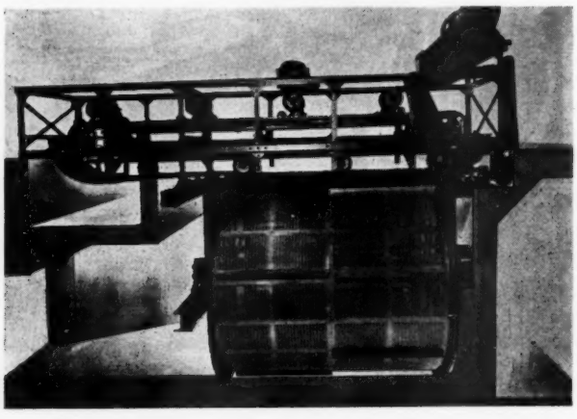


Part of plates of Dorr fine screen, of manganese bronze with milled slots 1/16"x2", giving 16.4% of area clear opening.

As the drum revolves it brings to the top the screenings left on the outer surface. Here they are brushed along the top by a series of brushes which revolve and at the same time move parallel to the axis and carry the screenings to a conveyor or receptacle at one end of the drum. As the motion of the brushes and of their revolution is parallel to the slots, particles adhering to the outside of the drum are picked up by the brush bristles, instead of being pushed through the slots into the screened liquid, as frequently happens when scrapers are used, or brushes which move across the slots.



Brush unit for Tark screen. Weight carried on rails.



Tark sewage screen, 8 ft. x 8 ft.; 5 h.p. motor.

The drum shaft and its bearings are below the level of the sewage, but an oil seal is provided to prevent the entrance of any water that may seep by the packing in the stuffing box; and there is no other part that is not easily accessible.

The drums are made of any size desired, from 4 ft. diameter up. Eight drums 8 ft. diameter and 8 ft. long at the Milwaukee plant now handle about 85 m.g.d. and can, it is claimed, handle 150 m.g.d. A screen with 1/32" slots removed 2200 pounds of screenings per million gallons, and another at the same plant with 3/64" slots removed 2,000 pounds. As much as 3,000 pounds per m.g. has been removed at another plant. (Two thousand pounds is equal to approximately 10% of the suspended solids.)

In the next installment we will publish additional matter concerning fine screens, including descriptions of band and wing screens.

NOTE: It is very probable that, in describing the mechanical equipment used in sewage treatment plants, some of the less commonly used will be overlooked. We urge those who know of any such to bring it to our attention, and we will publish such supplementary information each month, as addenda to the previous installments of this series.

Practical Concrete Construction Details

By William E. Barker

Highway Engineer, Portland Cement Association

II—The Selection of Aggregate for Different Classes of Concrete

There are three major considerations in the selection of aggregate for concrete: First, quality; second, economy; third, physical characteristics, such as size and color.

The QUALITIES commonly specified for coarse aggregate are durability, cleanness, freedom from coatings not permanently bonded, hardness, toughness, and sometimes compressive strength. They are all desirable, but in differing degrees, depending upon the use to which the concrete will be put.

Cleanness means freedom from clay, silt, loam and organic impurities. Mud balls are particularly objectionable because they usually float to the surface and later wash out, forming pits. Coal, lignite shale, sticks, chips, and like materials behave similarly and are equally objectionable.

Clay and dust, which form a coating on aggregate particles, keep the cement from bonding to them, materially reducing the strength of the concrete. Thorough washing, sometimes with an aggregate scrubber, is the remedy.

Finely divided clay and silt are not so harmful in mass concrete, especially in very lean mixes, where they may reduce the amount of water required to secure a given workability. These impurities are, however, especially objectionable in thin surfaces which have to be finished, such as walks and pavements, because they concentrate at the surface and may cause scaling. Most paving specifications limit clay and silt to 2 or 3 per cent in fine aggregate and 1 or 2 per cent in coarse.

Organic impurities, such as decayed vegetation, injure hardening concrete and are objectionable even in small quantities. They are most frequently encountered in sands taken from swamps or sluggish streams, or poorly stripped pits, and are detected by a chemical treatment known as the colorimetric test, and by making test specimens with suspected aggregate. If material does not pass the colorimetric test and test specimens develop low strength, it may be assumed that harmful quantities of organic impurities are present. Organic matter can often be removed by thorough washing.

Durability is ability to resist weathering, particularly the repeated freezing of absorbed moisture. To be durable, an aggregate should absorb little or no moisture and be strong enough to resist the stresses engendered when this moisture freezes. Durability is tested by saturating and freezing the aggregate, or by allowing it to absorb a salt, like sodium sulphate whose crystallization simulates the formation of ice.

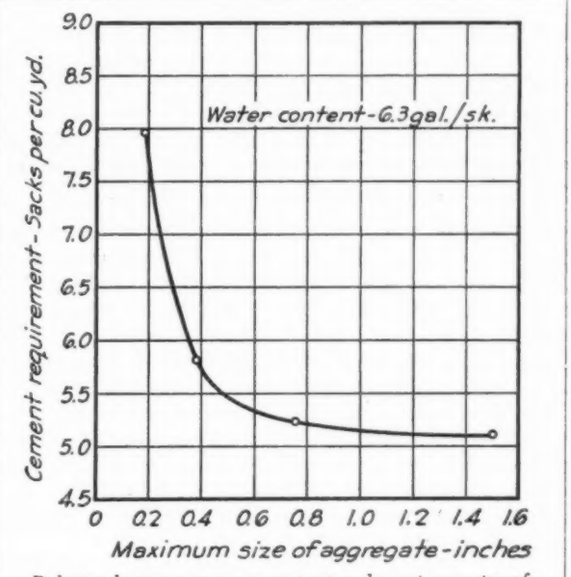
The more severe the climate, the greater care must be exercised in the selection of aggregate for durability. In southern Florida, for example, an extremely soft, porous rock proves satisfactory as a coarse aggregate for both structures and pavements, though it would not even be considered for concrete in northern states. Durable aggregate is especially necessary in structures which may become saturated such as shore protection walls, tanks, pavements and dams; and for lean mixes, because of lack of protection from the cement paste.

Hardness of aggregate is particularly desirable where concrete will be subjected to wear, as in pavements or industrial floors, especially if it will be used by many steel-tired vehicles or those equipped with tire chains. Aggregate for such locations is commonly permitted 7 per cent loss in the abrasion test for stone, or 15 per cent in the gravel test. For other types of structures softer stone may be safely used, and in the south, where tire chains are rare, softer stone is successful in pavements.

In some localities gravel aggregate has a coating which may be either soft, friable and easily broken off, or so hard and permanently bonded that it forms a part of the rock itself. No special tests have been proposed to determine just when such an aggregate should be used, but if it passes tests for hardness and durability there is every reason to believe that it will prove satisfactory.

Strength. In addition to tests for cleanness, fine aggregate is commonly made into mortar briquettes to be tested in tension. If the strengths secured are as high as those of similar mortar made with sand of known good quality the sand is acceptable.

ECONOMY comes next to quality in influencing the selection of aggregates. Greatest economy is attained when the cost of concrete in place in the structure is least. Cement being the most expensive ingredient, maximum economy is usually attained when the least cement is required to secure a concrete of the desired strength and workability.



Relation between cement content and maximum size of aggregate. Comparisons made at optimum gradation for each size. Slump 2" for all mixes.

Size of aggregate has considerable effect upon economy. The smaller the maximum size of aggregate particle, the more cement required per cubic yard of concrete. That is because mortar must coat all the surface of the coarse aggregate, and there is a larger area of surface in a unit volume of small sized aggregate than in an equal volume of larger sized particles. On the Hoover dam, for example, coarse aggregate having a maximum size of 9 inches is to be used. If the 9-inch stones were broken into smaller sizes, mortar would be required to coat the new surfaces formed by crushing, and the volume of mortar, and therefore of cement, per cubic yard of concrete would have to be increased.

PHYSICAL CHARACTERISTICS. There is a limit to the size of aggregate which can be used. In structures that are heavily reinforced, a size must be chosen which will readily pass between adjacent bars, as well as into corners in the forms. It is also best if the diameter of the aggregate is not more than one-fourth to one-fifth the thickness of the wall of structures in which it is to be used, or one-third the thickness of pavements. In buildings, a maximum size of 1 to 1½ inch is usually specified for the coarse aggregate. In pavements, where steel is absent or widely spaced, a maximum size of 2½ or 3 inches is generally used, while in dams 6 to 9 inches is common.

Grading of aggregate has much less effect on economy than does maximum size. For equal strengths, the cement content per cubic yard is nearly 4 sacks less for aggregate ranging in size from 0 to 2½ inches than for one from 0 to ¼ inch, but for the same maximum size any possible change in grading would not alter the cement content by more than ½ sack per cubic yard, provided the sand is correctly proportioned to the coarse aggregate. This fact should be noted carefully, as it is opposed to popular opinion. For fixed proportions, variations in grading may result in considerable variation in cement content.

Economy is also the ruling factor in the choice of type of aggregates. Though more expensive in first cost, for example, an extremely lightweight aggregate may prove economical because reduced dead load makes possible the use of smaller columns and shallower beams.

Gravel has a slight advantage over crushed stone because less mortar is required with it to secure a given degree of workability. But crushed stone of rough surface texture produces concrete of slightly higher flexural strength than gravel concrete of the same proportions. Where flexural strength is important, as in pavements, this higher strength of stone concrete may make up for the additional mortar required.

How to Make Watertight Concrete

By D. S. Mac Bride
Manager Incor Div., Lone Star Cement Co.

Probably no problem connected with construction is more discussed and generally less understood than that of producing a concrete which will be impervious to water. Certain it is that there are few shortcomings more difficult to correct than leakage through an improperly placed concrete wall. How to make impervious concrete is the subject of this article.

"THE most essential thing for waterproofed concrete is proper grading and proper making of the concrete," said P. H. Bates, Chief, Concrete and Ceramic Division, Bureau of Standards, Washington, D. C. "If you will examine any badly leaking concrete, I doubt whether you will ever find more than 10% of the concrete actually leaking. The other 90% is dry and impermeable."

Well-made concrete is of itself waterproof. Lack of uniformity in a concrete gives rise to local defects which frequently cause leakage. The study then centers around the consideration how best to make a *uniformly high-grade concrete.*

How Concrete Is Waterproofed

There are three generally accepted methods for producing waterproof concrete, each of which has its proper place. Those commonly used are:

1. Membrane coatings.
2. Integral compounds.
3. Dense, well made concrete.

The application of the last named is very much wider than that of the other two.

1. *Membrane or external coatings of waterproof material* are frequently applied to engineering structures where an extremely high degree of resistance is desired or water exposure is unusual. The use of this method is generally limited to surfaces exposed to standing water, such as decks of railroad bridges and foundation and retaining walls in wet soils. Membrane coatings are applied directly to the exposed surface to protect the concrete from contact with water. They are used only where there is a complete absence of abrasion or wear and where appearance is of little or no consideration.

2. *Integral waterproofing agents* are divided into two main groups: Those which are introduced into the concrete as a fifth ingredient and admixtures added to the cement during manufacture. There are some meritorious compounds in the former group, but the vast majority of those offered contribute little or nothing to the concrete, while they tend to lull the engineer into a false sense of security, which often leads to the neglect or slighting of the basic principles of good concrete making. Most of the compounds are water-repellent and in general it may be said that the water-repellent action of the treated cement is reflected in a resistance of the passage of moisture through a wall. But neither a fifth ingredient nor treated cement, of and by itself, can produce watertight concrete. Their success or failure depends upon whether the concrete is uniform, properly cured and strong. Moisture-proofed cements enjoy little, if any, advantage over the untreated product when the latter is incorporated in a dense, well-made concrete, and use of the latter is much less expensive.

3. *Well-made concrete* has been shown by innumerable tests in the laboratory and field to be the most reliable and dependable means for securing a high degree of water resistance. In his paper "Basic Principles of Concrete Making" (Civil Engineering, April, 1931) F. R. McMillan, Director of Research, Portland Cement Association, shows that there is a close interrelation between density, durability, strength, resistance to wear and watertightness. Mr. McMillan shows that a concrete made from sound, well-graded aggregates (almost without regard to the maximum size, shape of particle or strength of the stone itself), if proportioned so as to produce a dense, workable concrete, can have all the desired watertight characteristics; and that, in a concrete so made, the compressive strength, durability and watertightness depend upon:

1. Relative proportions of cement and water, or water-cement ratio.
2. Completeness of the chemical combination between the cement and water—i. e., curing.
3. Characteristics of the cement.

To a limited extent the water-cement ratio which can be used depends upon the characteristics of the cement, as does the effectiveness of a given amount of field curing. It would seem, therefore, that the characteristics of the cement should receive major consideration in any discussion of watertight concrete.

During the past ten years great improvements have been made in portland cement. Transition in chemical composition has been made possible by more accurate proportioning of the raw materials and more complete combination in the kiln; and this combined with finer grinding have materially reduced the time necessary for concrete to acquire service-strength and shortened the duration of the curing period. Today a portland cement concrete which has been efficiently cured for say two weeks has been given a better start in life than would the concrete of a decade ago after curing for a month or more. The way has been found to produce cements which have three times the 24-hour strength of ordinary portland cement. These high-early-strength cements generally produce a concrete which is more plastic and less subject to segregation. Since their reaction is more rapid, the usual field curing produces a greater effect than on slower hardening ordinary portlands. Not only are early strengths materially greater, but the ultimate strengths of high-early-strength concretes are generally higher than of those made with ordinary portland cement.

Properties of Watertight Concrete

Study both in the laboratory and in the field of concrete subjected to water pressure indicates that ability to completely block the passage of water de-

pends upon three basic characteristics, and these are to a large extent interdependent; in improving one, the other two also benefit. To be watertight the concrete must be:

1. Dense and uniform.
2. Thoroughly cured.
3. Strong.

1. *Density and uniformity* are obtained through the use of well-graded, properly proportioned aggregates, a water-ratio which results in a workable concrete free from segregation and a cement which imparts to the wet mix a cohesive, jelly-like consistency. A concrete which has the ability to withstand handling without segregation is usually dense and uniform. This latter is of major importance.

2. *Thorough curing* has been called the most profitable insurance against pervious concrete. More real waterproofing qualities can be imparted to a concrete during the few hours and days immediately following the placing than in any other manner. By curing is meant the prevention of surface evaporation, beginning as soon as the concrete stiffens and terminating when an ecoonmic time limit has been reached. The longer curing continues the more complete becomes the hydration of the cement, but at a diminishing rate from day to day or from week to week. The effect of inefficient curing is no greater than that of good curing over a much shorter period of time, and of the two the latter is usually the more effective.

3. *As concrete becomes stronger* it also becomes more watertight. Given two dense, uniform concretes, the stronger will show greater resistance to the passage of water than will the weaker.

Note how these three qualifications depend one on the other: plasticity and workability are a practical requirement for a uniform dense concrete. Uniformity and density make good curing more effective and increase strength. Curing actually increases density and materially raises concrete strength. Strength is influenced by density and curing, but it is also a reflection of the properties of the cement. The strength obtained from a concrete of a given density which has been cured for a given period will be a direct reflection of the strength-gaining characteristics of the cement itself.

Effect of Cement Characteristics

Using a definite combination of given aggregates, modern portlands, due to finer grinding and better composition and processing, impart to the concrete a degree of workability and plasticity which was heretofore unknown. High-early-strength cements, particularly those produced by a more thorough manufacturing process, produce a concrete able to resist handling with less segregation and which rolls into forms and around reinforcements with minimum effort, and results in dense, uniform, homogeneous concretes.

Whether curing is efficient or not depends upon the manner and the amount of water applied and the rate at which it is taken away by evaporation, absorption or run off. Protective coverings such as burlap hold the moisture and prevent evaporation from the concrete so long as the covering remains saturated. As job conditions allow curing operations to continue for only a limited period of time, the effect of the curing depends upon the rapidity with which the cement reacts to the presence of water. This reaction, known as hydration, proceeds at a moderate rate in ordinary portlands and at a rapid rate in high-early-strength cements.

For example, under efficient curing an ordinary portland cement concrete has at 7 days approximately one-third of the strength which it would gain after one year of continuous curing, while well made high-early-strength portland cements under a similar treatment have two-thirds of the one-year strength at 7 days. If we assume that the one-year strengths are equal (high-early-strength concrete generally shows a one year concrete strength 10 to 15% higher than does ordinary portland cement), then the high-early-strength cement concrete will, after 7 days' curing, have double the strength, which an ordinary cement concrete would have. And since strength does not increase after the concrete has dried out, and the only time periods of importance when computing strength are those during which the concrete has been kept wet, this applies also, to a large extent, to the ultimate strength obtained and its durability as well.

It is true that under 100% efficient laboratory

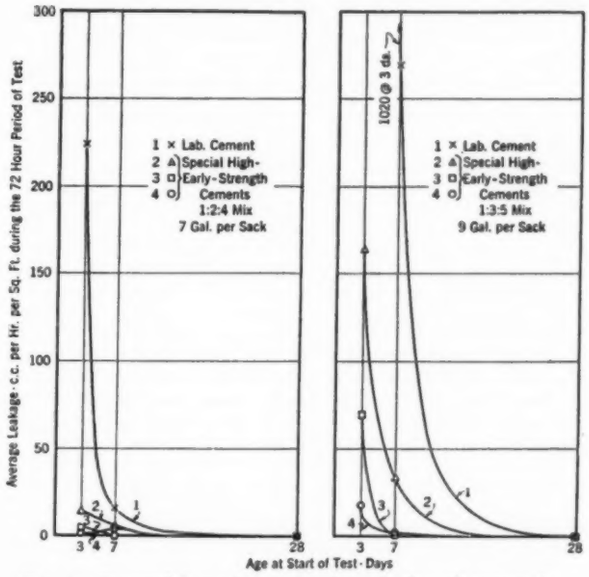


Fig. 1—Permeability of concrete from high-early-strength cements.

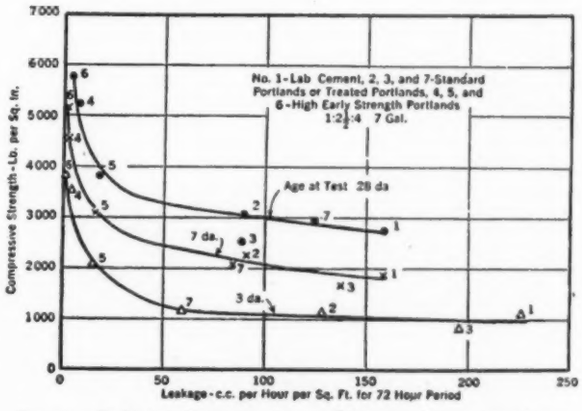


Fig. 2—Relation between permeability and compressive strength. Standard and high-early-strength cements.

curing the compressive strength of concretes at remote periods tend to reach a common level; but field conditions produce vastly different results, for in practice concrete is cured for only a given length of time, and the net result will reflect the ability of the cement to make the most of the curing it receives during that time. Under short or inefficient curing, if the cement reacts slowly, strengths will be low, but if rapidly, maximum advantage will be obtained from whatever curing the concrete receives.

The amount of curing required by a particle of ordinary portland cement is independent of the amount in the concrete; if a 1:2:4 concrete made with ordinary portland should have 10 days curing, so should a 1:1:2 mix. It follows, therefore, that certain equivalents can be developed between curing times, based on the properties of the cement itslf. If 14 days' curing has been found necessary, using ordinary portland cement, to obtain a given strength, it seems logical to continue the curing of a concrete made with high-early-strength cement only until a similar strength value has been developed. Thus we may find that two weeks for ordinary cement may be the equivalent of three days with high-early-strength; eight days equivalent to one day, etc.

To illustrate these points, note relationships established in Figure 1, from Mr. McMillan's paper above referred to. The permeability of two concrete mixtures has been studied at ages of from 3 to 28 days. Note, first, that the leakage in the left-hand diagram is less than that indicated by the right—in other words, the stronger concrete is more nearly watertight. In this series, the cement indicated by numeral 1 was a mixture of four ordinary portland cements; those indicated by numerals 2, 3, and 4 were three high-early-strength cements. Note that under ideal curing, all of the concrete specimens became watertight before the 28-day period had been reached; but in the field, curing is rarely ideal for as long as 28 days.

It therefore is desirable to determine the effect of shorter curing periods. Note in the right-hand diagram that if curing had been carried on effectively for but 7 days, the ordinary concrete would have shown a high rate of leakage, while one of the high-early-strength cements would have produced concrete just short of watertight, and the other two cements had achieved complete watertightness in that time. Using the better concrete represented by the left-hand diagram, it is seen that after three days' curing, ordinary portlands show leakage while two of the high-early-strength cements are practically tight. At 7 days, leakage in the ordinary portlands has been reduced to a negligible amount, while the high-early-strength cements have achieved watertightness. These diagrams clearly illustrate the effect which the properties of the cement itself have upon the resulting watertight characteristics of the concrete.

In Figure 2 (also taken from Mr. McMillan's paper) are plotted strength and leakage for three kinds of cement. As should be expected, greater leakage is indicated by the weaker concretes, while those developing high strengths are practically watertight. To the right in the diagram, showing the greatest leakage and the lowest strength, is the ordinary portland. Toward the left, exhibiting but slightly higher strength accompanied by somewhat less leakage is a group of three portland cements which have been treated during manufacture with water-repellent agents. On the left-hand side of the diagram is a group of three high-early-strength cements, whose high compressive strength is reflected in little or no leakage, these being practically watertight at the three-day period while the treated portlands and the ordinary portland indicate a considerable flow through the concrete.

Application

The practical applications of the principles herein set forth are numerous. There are many structures, some important, others humble, which illustrate the economic value of rapid-hardening cement in the production of watertight concrete:

In casting floor slabs for the double-leaf bascule Wabash Avenue bridge in Chicago the Benedict Stone Products Company used a high-early-strength cement in a 1:1½:2½ concrete having four gallons of water per sack of cement. High-early-strength cement was used on this job because refilling of forms was an essential part of the manufacturing program and because watertight, dense, durable concrete was required. Forms were re-used daily, in some cases after eight hours with the aid of steam curing. Slabs 12 ft. long and 5¾" thick were swung into place on the bridge by a four-point suspension within three days after casting, when necessary. It was most important that accurate balance be maintained between the bascule leaves and their counter weights to permit ready opening and closing of the spans; and during more than a year since the completion of this concrete floor, changing weather and traffic have had no effect upon this balance because this concrete does not absorb water.

In August, 1929, the Walnut Grove Dairy at Alton, Illinois, replaced a badly worn and patched floor. The plant was in operation for the entire day save the five-hour period from midnight to 5 A. M., and replacement had to be made during that time and the floor ready for use when operations were resumed. This was possible by using high-early-strength cement, and the resultant floor, after three years of hard service, shows no signs of hard use or attack by lactic acid.

The City of Nyack, N. Y., in 1929 enlarged and relined a 750,000-gallon reservoir, which was roofless and leaking badly through its stone masonry walls. The floor of the reservoir was repaved and the side walls relined and raised. High-early strength cement was used in a 1:2:4 concrete because public health and fire protection demanded quick work, and side forms were removed after 16 hours. Also good engineering required concrete of high strength, durability and watertightness. Ordinary portland cement could not have met these requirements, particularly in the cold weather of early winter during which the work was done. High-early-strength cement concrete was also used in constructing a roof, and roof forms and supports were removed 24 hours after placing concrete. The reservoir was immediately put in service and found to be watertight, elimination of leakage resulting in a reduction of $6,000 a year in pumping costs.

Numerous other examples might be cited, all indicating a similar conclusion—namely, that with good materials and good workmanship a watertight concrete can be obtained with a high degree of certainty and at moderate cost without recourse to the use of a fifth ingredient.

Sewage Treatment in Indiana

The law giving the Indiana State Conservation Commission jurisdiction over the pollution of streams in that state has been upheld by the Supreme Court, and it is expected that, as soon as the present depression has passed, the commission is to proceed to exercise its powers and require the construction of many sewage treatment plants in that state.

Improved Equipment and Methods for Concrete Pavement Construction*

By P. M. Tebbs
Assistant Chief Engineer, Pennsylvania Dept. of Highways

IT IS in the construction of the pavement itself more even than in earth handling and grading machinery that the greatest changes in type of equipment and methods of operation have been made.

Handling Aggregates—Storage of aggregates in small piles upon the subgrade and charging them into the mixer skip with wheelbarrows was a great waste of human exertion, besides insuring a pavement filled with pot holes, caused by pieces of mud and other foreign materials working their way to the top of the pavement during the fabricating process. In 1921, batch hauling in trucks and industrial railway made its first appearance and completely revolutionized the equipment for unloading, handling and hauling materials, increasing production and decreasing costs, and increasing measurably the quality of the pavement. For the first time concrete pavers completed more than a mile of pavement per month. Maximum weight trucks with solid tires were favored for several years and it actually required specification changes to educate the majority of our contractors to the numerous advantages of the lighter type, two or three-batch pneumatic-tired trucks. Industrial railway haulage, while it may have considerable merit in prairie states, has become obsolete in Pennsylvania.

There has been constant improvement in the types and designs of proportioning plants, all tending towards ease of setting up, speed of operation, automatic control and minimum of effort required to operate; all of which tend to improve the finished product, especially the weight control of aggregate now in universal practice.

Cement Handling—Storing cement on the subgrade and dumping it direct into the skip of the mixer was followed by placing the cement in bags on top of the aggregate and dumping it on each batch at the mixer before charging the skip. A still further reduction in handling was made by use of separate weather-proof cement boxes on the trucks, which were loaded at the proportioning plant and dumped with the aggregate into the skip. This led to the use of bulk cement, for which there now are many types of unloading and weighing plants, varying from the high-priced plants in which the only labor employed are the men who weigh the material, to those in which the cement is loaded, hauled, weighed and dumped by hand labor into the truck compartments. All of these plants save in labor costs as compared with handling cement in bags. The depreciation and upkeep charges of the higher priced plants are often greater than the additional labor cost involved in operating the cheaper type.

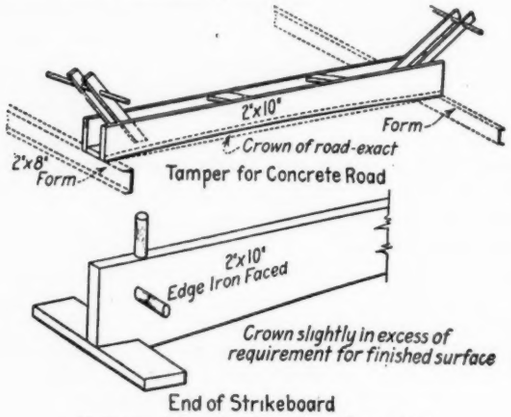
Placing Reinforcement—Prior to the year 1924, wire mesh was used exclusively for reinforcing concrete pavements. In 1923 a sled device was introduced for supporting the mesh in proper position in order that the concrete could be poured for the full depth through the mesh and not retard progress by having to pour it in two courses, but its use was prohibited on account of voids left in the concrete as the sled was moved ahead, and because it was difficult to check the subgrade in the proper manner. A device for suspending the mesh in proper position was permitted, but required practically the same number of men and delayed the placing of concrete

*Concluded from the June issue.

Laying concrete pavement in 1917. Aggregate and cement piled along right-of-way. Thirty-two men in the gang. Steam-operated mixer.

until the entire mixing pit had cleared and checked, thereby delaying progress. This same delay occurred when marginal bar reinforcement was in common use from 1924 to 1927 inclusive. To eliminate these objectionable features, a Pennsylvania contractor developed the mechanical strike-off templet. This equipment as first used in 1929 consisted of an ordinary wooden templet which operated on the forms and struck off the concrete for the full length of pit, being pulled toward the mixer by a power take-off utilizing the drum on the mixer used for handling batch boxes.

This method proved to be so effective that the mixer manufacturers arranged to furnish it on new mixers and attach it to old mixers, and mechanical striking off of concrete was made mandatory in the 1930 specifications. On especially efficient jobs its use was developed to the extent that the pit crew was reduced to three men and the mechanical strike-off spread the bottom course with little or no hand spreading being necessary except against the forms. In 1931, the templet was improved to provide greater clearance between templet and bucket, which resulted in still more efficient operation.



Tamper and strike board used in 1915

Finishing Machines—The first finishing machines of the "tamper" type eliminated the hardest and most tedious of the hand labor operations and dispensed with at least two laborers. This type was succeeded by the "Screed" or combination "Screed and Tamper" types. In addition to the direct labor saving, progress was increased and pavements were improved by the use of concrete of a much drier consistency. The first machines produced a rougher riding pavement than the hand finished product, but improved mechanism and more experienced operators have corrected this, and the machine-finished product of today has the best riding surface that has ever been constructed.

Curing—At first calcium chloride was mixed by hand and placed in the drum by hand labor, but the modern concrete paver is equipped with automatic mixing and a positive automatic mechanical method adds this solution in the drum of the mixer. Thus one or two men have been eliminated and positive curing is being secured with a minimum of human effort. In certain States where the "wet cover method" of curing is still practiced, mechanical watering devices have supplanted the man or boy with the hose.

Mixers—The design of concrete pavers has progressed consistently towards larger and faster machines, with special emphasis upon speed of loading and discharging, including automatic features. There have been requests for larger machines, but the manufacturers feel that failure of the user to secure maximum production from the present equipment does not warrant the cost of designing, testing and manufacturing a larger mobile unit than the 27E paver.

The use of ready mixed and transit mixed concrete has grown considerably in the past few years and, under rigid specifications and not too long a haul, has proved successful in reducing fabricating costs and providing a satisfactory pavement. One of the main objections to this type of concrete construction has been damage to the subgrade, especially after it has been prepared and checked, resulting in delays to correct and direct cost of repairs.

The development of a belt conveyor for transferring concrete of this kind from the truck to the subgrade permits the truck to operate outside of the forms, which saves the time required to back it into the proper position and prevents rutting of the subgrade by the truck.

One of the great advantages of using ready or transit-mixed concrete is the ability to keep going in event of breakdowns. As a general rule, not over one truck should require repairs at a time, while if a concrete paver is broken down, the job must be suspended until repairs are made. The initial cost of equipment for transit mixed and ready mixed concrete is an item which must be balanced against any increased production which is possible by this method.

Tandem mixers have been used in several western States. The reports appear to be fairly satisfactory on increased production, but are rather meagre on costs of construction and satisfactory condition of completed product.

A summary of average unit costs of reinforced concrete pavements for the years 1921 to 1931, inclusive, is as follows:

Year	Type	Unit Costs—Per Square Yard	Unit Costs—Per Cubic Yard
1921	5-7-5	$3.530	$20.070
1922	5-7-5	2.830	16.090
1923	9-6-6-9	3.550	18.260
1924	9-6-6-9	3.538	18.200
1925	8-6-8	3.374	18.218
1926	8-6-8	3.038	16.404
1927	8-6-8	2.701	14.580
1928	8-6-8	2.796	15.100
1929	8-6-8	2.736	14.770
1930	8-6-8	2.790	15.060
1931	8-6-8	1.948	10.520

These figures show a considerable reduction in 1922 prices as compared with 1921. In 1923, 1924 and 1925, changes in design tended to increase prices, which increases were not otherwise justified. The year 1926 showed a considerable reduction. From this year to 1930 inclusive a fairly uniform price level was maintained. The general trend from 1921 to 1930 inclusive was towards lower prices. In 1931 there was a reduction of one-third below the 1929 levels. This can be explained in part by the depression, but it is also due to a very considerable extent to the studies and recommendations made by the Department in 1929 and 1930 and made available to all of the contractors of Pennsylvania. These studies revealed that no equipment or method can be more efficient than the organization which operates it.

How Tennessee Satisfactorily Surface-Treats Gravel and Chert Roads

By Briggs Smith
Division Engineer, Tennessee Dept. of Highways and Public Works

APPROXIMATELY six years ago the Tennessee Department of Highways began efforts to eliminate the dust nuisance on its highways. The use of a prime coat of low-viscosity tar gave good results on well compacted crushed stone, but when applied to gravel or old chert, chuck holes appeared in a short time. A large mileage of the state highway system was being maintained with dirty gravel, chert and crusher-run limestone, and it was necessary to find a treatment which would be satisfactory on these roads, and in developing a satisfactory standard surface treatment method a number of experiments were tried.

The term "surface treatment" is applied by the Tennessee state department to the mechanical mixing of aggregate and bitumen directly on the road base, obtaining a total thickness of approximately ⅞" for a wearing course, as well as being a dust preventive. A treatment of freeing the road from dust and foreign matter and spraying with a low-viscosity tar or light oil is called a prime coat; and if sprayed with hot bitumen and covered with stone chips or pea gravel it is called carpet treatment.

Among the experiments tried was the Wisconsin method, used on an old gravel road which had about 70 pounds per square yard of floating material. The floating material (which was creek run gravel 1½" down) was bladed to one side of the road and the exposed half of the base was broomed and primed with approximately .4 of a gallon of tar per square yard, having a specific viscosity of 6 to 13. The floating material was then bladed back across the road over the primed section to the opposite side, and the remaining portion of the base which was then exposed was thoroughly cleaned by brooming and then primed. The entire amount of the floating material was then spread uniformly over the road and sprayed with a power distributor, using approximately .6 of a gallon per square yard of tar having a specific viscosity of about 20. The sprayed gravel was then worked back and forth across the road with a power grader until the tar and gravel were thoroughly mixed, additional tar being added where necesssary. This material was then worked each day for two or three days, or until the mixture became stiff enough to be spread across the road and rolled. It required about three days for enough volatile matter to evaporate to leave the mixture stiff enough to stay in place when rolled; even then it was necessary to patch out an occasional rut made by cars. The riding quality of the surface thus obtained was very good; however, the surface began to corrugate a few months later, due to improper gradation of the aggregate.

In a second experiment a section of a chert road was scarified to a depth of four inches and the chert thoroughly broken up and then sprayed with tar, mixed and rolled as previously described. The result was the same, in that the road surface soon became corrugated.

In a third experiment the Wisconsin method was tried on a well maintained crushed stone road, which had ample floating material of 1½" crusher run stone. The result obtained on this section was better than the other experiments, in that the corrugations were not so frequent or pronounced.

The carpet treatment type of surface has been satisfactorily durable, but was not as smooth as the mixed-in-place type and for this reason is not used very much.

The result of the various experiments was the adoption of a standard procedure using 80 pounds of stone per square yard, 0.3 to 0.4 of a gallon of tar (specification M-1) per square yard as a prime, and 0.6 of a gallon of tar (specification M-3) per square yard to bond the stone. Gravel has been used as an aggregate instead of stone in some cases, but requires about 0.2 gallon of tar more per square yard to bond it than is required of stone.

About three years ago the use of cut-back asphalt was adopted for tying the stone because it was cheaper than tar, but tar was retained as a priming material, having proved to be the best for that purpose. Seven-tenths to 0.8 gallon of cut-back asphalt (specification M-4) is required per square yard to bind 80 pounds

Distributor for oil, tar and asphalt.

Spreading chips, 8 lbs. per square yard.

of stone. The traveling public is not inconvenienced as long by having to travel through a bituminous mixture where cut-back asphalt instead of tar is used as the binding material, since the volatile matter in the cut-back sphalt evaporates within a few hours after it is sprayed on the road, leaving the mixture sticky and ready for the roller, while two or three days must elapse before tar is stiff enough to be rolled.

Construction Method

Clean the base of all dust and foreign matter, prime the dry base with 0.3 to 0.4 of a gallon of tar, specification M-1, per square yard. Patch all noticeable depressions in the surface before stone is spread on the road; after this has been done, spread 80 pounds of stone, specification M-54, per square yard on the primed road bed. After leveling the stone with a power grader, spray it with 0.4 of a gallon of tar or 0.6 of a gallon of cut-back asphalt per square yard. If asphalt is used to bind the stone, the mixture is bladed with a power grader, turning it over at least seven times before rolling it, being bladed and rolled immediately after the asphalt has been poured. When tar is used as the bitumen, the mixture is turned over three or four times each day for three days until it becomes stiff, and then it is spread uniformly over the road and rolled. If it is not possible to continuously turn the mixture until it has reached the stage to be rolled, do not windrow it in the middle of the road, but windrow one-half of it to each side of the road or all of it to one side, since the former would give an excess of bitumen in the center when it is needed on the side of the road, and also would inconvenience traffic more than having the windrow on the side of the road. All depressions in the surface are patched during the process of rolling, with the same mixture of stone and bitumen as used in the original surface work. Whichever binding material is used, the road should be rolled with a 5-ton roller until the surface is tight and does not pick up, and be rolled three or four times each day for three or four days, or until the surface appears to have a gray color. When the rolling is completed the surface should be thoroughly keyed and tight. The thickness of this surface is approximately ⅞ of an inch.

The surface obtained by the above described method is very porous and if not given more attention will soon begin to ravel. In order to eliminate this condition, the road is then covered with 8 pounds of chips, specification M-57, per square yard, which are broomed into the voids by either hand brooms or a broom attached to a tractor, and rolled, and brooming and rolling are continued until all voids are filled. The choked surface should then be subjected to traffic for two days in order that traffic may blow off the dust which might have been in the chips originally or was made by rolling them. (It is not advisable to attempt to broom the dust from the chipped surface, since the broom will pull a considerable amount of the stone from the voids.) It is then sprayed with 0.2 of a gallon of tar, specification M-3, or asphalt, specification M-4, per square yard. The sprayed chips are then broomed until they are tied to the base. A well compacted and sealed surface is the result. In order to give the road a finished appearance, the edges of the surface are lined before the shoulders are constructed.

Surface treatment work should not be attempted in rainy or cold weather and the stone should be dry before it is sprayed with bitumen material. The best results cannot be had if the temperature is below 50 degrees F. when the work is being done. Much better results can be had by doing the work in the early spring than in the late fall; generally speaking, surface treatment work should not be attempted after October 15th.

The equipment necessary for an oiling outfit consists of:

5—3-yard trucks
2—10-foot one-man graders
2 or 3—5-ton rollers
1—Loader
1—800 gal. distributor
1—Broom and tractor
1—2-ton truck
1—Automobile

The laboring force consists of:

1—Foreman
5—Truck drivers
2—Grader men
3—Roller men
1—Tractor operator
1—Broom operator
1—Distributor driver
1—Distributor operator
5—Laborers
2—Loader operators

Under normal conditions this force can construct an average of one-half mile per day at a unit cost of from twenty cents to twenty-five cents per square yard.

Specifications

The specification M-1 calls for a high-carbon tar, specific viscosity, Engler, 10-20; total distillate, 0-170° C., not more than 7%, up to not more than 35% for 0-300° C. Softening point (ring and ball method) of residue from distillation, not more than 60° C. Total bitumen soluble in carbon disulphide, 88 to 97%.

Specification M-4 calls for a blend of asphalt cement and petroleum naphtha having a viscosity at 122° F. of 80 to 120 sec., homogeneous and free from water. When the components are separated and recovered, the asphalt cement shall have a penetration of 80-105 at 77° F., 100 g., 5 sec.; not less than 99.5% bitumen soluble in carbon disulphide; not less than 99.0% soluble in carbon tetrachloride, and not less than 50 cm. ductility at 77° F.; while the recovered naphtha shall show a distillation range, total distillate to 302° F.—15-35%, and end point 400-450° F., and a continuous chain of boiling points throughout its entire distillation range.

Specification M-54 calls for clean, tough, durable stone, not more than 6% wear and toughness not less than 6, and shall meet 5 reversals of the accelerated soundness test as prescribed by the U. S. Dept. of Agriculture; broken so that not more than 3% is retained on a 1" screen, 75-100% on a ⅜" screen, and 97-100% on a 4-mesh sieve.

Specification M-55 calls for gravel, clean, tough, durable; not more than 15% abrasion (by U. S. Dept. of Agriculture Method No. 4); not more than 5% of soft fragments, shale, clay, shell and other foreign matters; not more than 4% shall pass an 8-mesh sieve.

Specification M-56 calls for stone chips from rock meeting requirements of specification M-54 and 0-3%, remaining on a ¾" square screen, 70-95% on a 4-mesh sieve and 95-100% on an 8-mesh sieve.

Specification M-57 is for torpedo gravel and stone, and calls for materials meeting the requirements of M-54 or M-55, 0-3% retained on a ½" laboratory screen, up to 97-100% on a 14-mesh sieve.

The above is condensed from a paper read before the Tennessee Road School by Mr. Briggs Smith, division engineer of the Department of Highways and Public Works of that state.

THE EDITOR'S PAGE

That Nirgend Plant

Quite a number of our readers seem to have been "intrigued" (to use a much misused word) by our description last month of "Sewage Treatment without Bacterial Action" at Nirgend. One told us that he went through the atlas of the United States with a fine-tooth comb looking for a place of that name. We certainly had no intention to deceive in writing a realistic description, for we not only stated in italics at the end of the article that what we had described was only a prophetic vision, but the name we assigned to the city is German for "nowhere," and that of the superintendent is latin for "no one."

One or two have called our attention to the failure of centrifuges and screw conveyors in dewatering and handling sludge in the Milwaukee experiments, as indicating the impracticability of these two features of the Nirgend plant. But many others have refused to accept these results as final, and at least two centrifuges are "almost ready" for announcement as successful sludge dewaterers, while screenings from fine screens are being handled by a worm screw in the new London, Ontario, sewage treatment plant, which is described in this issue.

As a matter of fact, we believe that we used too little imagination instead of too much, and that we anticipated by only two years, rather than by ten, the time when most if not all of the features of the dream will come true.

Articles Recently Requested by Our Readers

At least four or five requests have been received from our readers for articles on each of the topics named below. We hope that any who have had experiences along the various lines referred to will help us to meet these requests by sending us descriptions of them, The subjects are:

- Sewer (and Other Small) Tunnel Construction
- Brick Paving and Resurfacing
- Engineers' Records
- Assessment and Finance Methods
- Storm Drainage (Including Financing)
- Road Oiling
- Small Sewage Treatment Plants

The Expensiveness of Careless Work

Watertightness in concrete can be secured only by having every part of every batch properly proportioned and thoroughly mixed. Even in porous concrete, ninety percent is probably watertight, and porosity and decreased strength are due to carelessness in mixing the other ten percent. So says the author of an article in this issue.

Another article describes a sanitary sewerage system so carelessly built that ground and surface water entering leaky joints in pipes and manholes amounted to many times the legitimate flow and the capacity of the sewage treatment plant; and as this plant had been carelessly designed, more carelessly built and most carelessly operated, the result was almost the maximum possible degree of ineffectiveness.

The leakage from a water distribution system need not exceed ten percent of the consumption. In some cities it is twenty, thirty, forty percent, probably due to carelessness in not securing a firm but non-rigid bed for the pipe and in not testing to see that all joints were calked tight; and afterward, in not making a leakage survey from time to time and locating and correcting the underground leaks.

The cost of repairing a leaky reservoir, leaky sewers, a broken-down treatment plant or leaky water mains is many times that of taking care to do a thoroughly good job in the first place and to keep it in good condition thereafter.

Announcing a Chair of Mental Temptation

Beginning with this issue, the "Brain Teasers" section, which appears on page 11, will be conducted by Benjamin Eisner, of Taylor & Eisner, Consulting Engineers, Military Park Bldg., Newark, N. J. Mr. Eisner has long been one of the kingfish in the problem solving business, though there are a lot of other mathematical sharks that chip in solutions regularly.

But anyway, turn to page 11 and see if Mr. Eisner hasn't made a good start with his column of "mental temptation." The matter of the vandalic steeplejack shall receive our own attention just as soon as we have finished filling the great open spaces still yawning on this page.

Solutions may be sent to this office, as in the past, where they will be read and greatly enjoyed—also as in the past. And if you have any super-teasers, send them in. We must keep Mr. Eisner in practice.

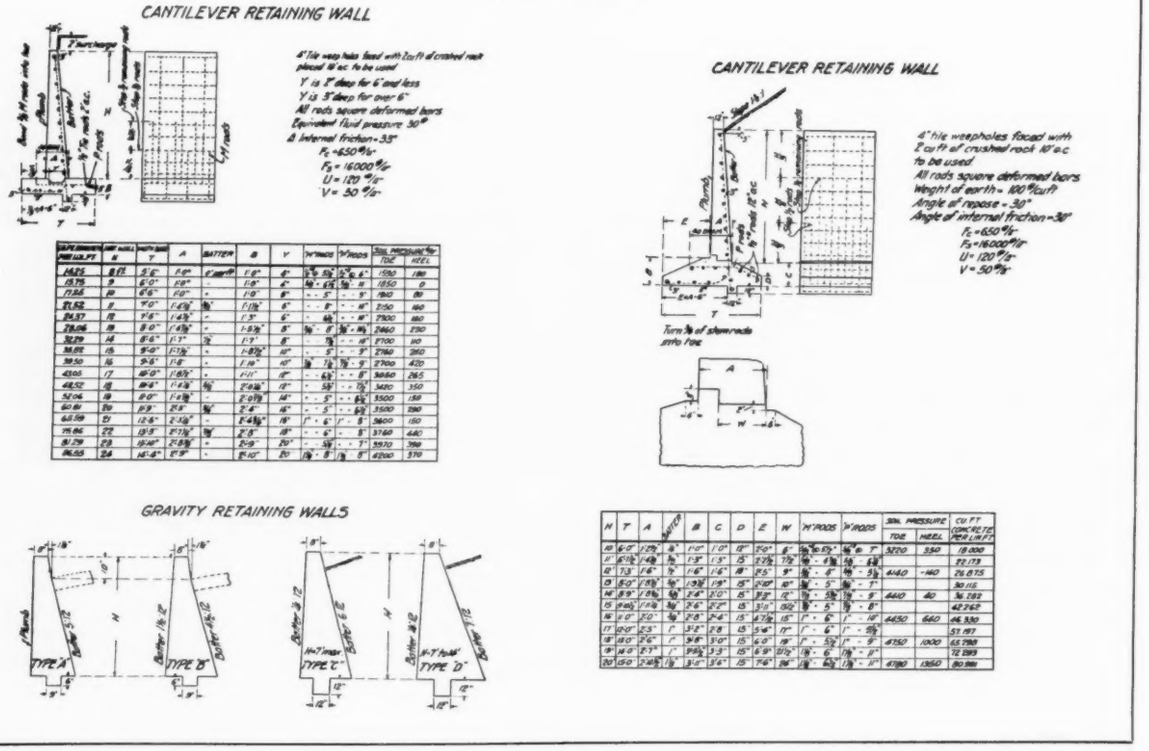
The Civil Service Situation

The U. S. Civil Service Commission has issued a warning against paying money for "coaching" courses in preparation for Federal civil service examination. It states that comparatively few appointments are now being made, since vacancies which must be filled are filled principally by transfer; and that large registers of eligibles exist as a result of examinations held during the year.

The publishers of PUBLIC WORKS are willing to do anything within their power to assist unemployed engineers, since it is a matter in which they are deeply interested. But they believe that it is their duty at this time to point out emphatically the fact that openings through the Federal civil service are very few and far between, and that it is practically always a waste of money to pay for coaching at this time.

Short Cuts in Retaining Wall Design

By D. Y. Bate



Equipment and Bituminous Treatment Methods for Macadam and Gravel Roads

By H. E. Sargent

Commissioner Vermont Department of Highways

THE use of the drag, the re-tread mixer, and the blade grader, together with the development of cut-back asphalts, emulsions and re-tread tars, has revolutionized the art of constructing and maintaining bituminous treated gravel and broken stone surfaces. The poor riding qualities of these roads heretofore were chiefly due to the fact that hand labor was used to such a great extent in spreading the aggregates. The less costly the type of surface, the more pronounced was this defect, for it was the lower-cost roads that were likely to be built with local inexperienced labor.

The drag and the grader have long been used in the construction and maintenance of chloride treated gravel roads which, under favorable conditions, have the best riding qualities of any road built. Today, with the use of the drag and the grader we are building, with a minimum of hand labor, low-cost bituminous-treated surfaces that possess excellent riding qualities, and by the same methods are retaining them so and are retreating and prolonging the useful life of our old macadam roads.

Bituminous treated gravel roads. Building a mixed-in-place gravel surface gives at once a uniform thickness of surface, which, by the old methods of surface treatment, was almost impossible to obtain except by years of treatment; also it gives a greater thickness of road surface than is obtained by penetration with the same amount of tar. The first essentials for bituminous treated gravel or thin broken stone surfaces are proper drainage and adequate foundation. The next is the shaping of this sub-base to a true and even cross-section and grade. Constant vigilance must be used to see that there are no irregularities between the 50 ft. stakes, and the drag or grader should be used daily. When building a new sub-base, a 10-ton or heavier roller should be used if available to accelerate the compaction. To construct a smooth riding road, the best results will be obtained by having the same operator with the same equipment shape both subgrade and surface. The subgrade should be as true as the surface.

A prime coat of tar, ¼ to 1/3 gal. per sq. yd., is applied immediately and allowed to penetrate. Surface operations should not begin until at least a week after this.

The gravel surfacing with a maximum size of 1¾ inches is carefully spread to a uniform depth of 2½

Self-cleaning — that and powerful stay-on-the-road traction — are two of the distinct advantages of the Goodyear Pneumatic Lug Tractor Tires shown on this power grader.

SEE THE BIG DIFFERENCE

THE big difference in favor of equipping your grader with Goodyear Pneumatic Lug Tractor Tires is that these Goodyears *are built for the job.*

They are *not* just a modified form of truck tire. They are a *"road-job"* tire.

Note the design and construction that give the Goodyear Pneumatic Lug Tractor Tires the advantage on building and re-surfacing jobs.

Its tread design is self-cleaning.

Being clean, that deep, thick, powerful tread always bears down with ample traction for straight forward motion.

Its special Goodyear rubber offers extreme resistance to oil-acid solutions and the abrasive action of sharp surface rock.

Why not get complete information about these more efficient, more economical tires for your equipment? Write or call the Government Sales Department, Goodyear, Akron, Ohio, or Los Angeles, Calif., or your nearest Goodyear Service Station Dealer.

TUNE IN:

Goodyear invites you to hear the Revelers Quartet, Goodyear Concert-Dance Orchestra and a feature guest artist every Wednesday night, over N.B.C. Red Network, WEAF and Associated Stations

GOODYEAR

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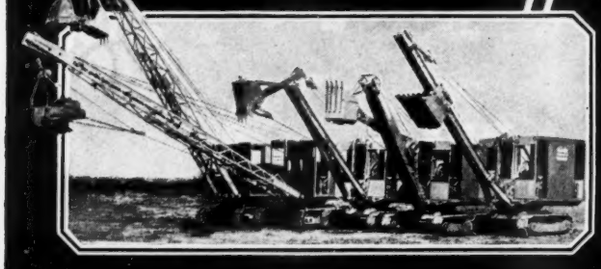
The General's Staff



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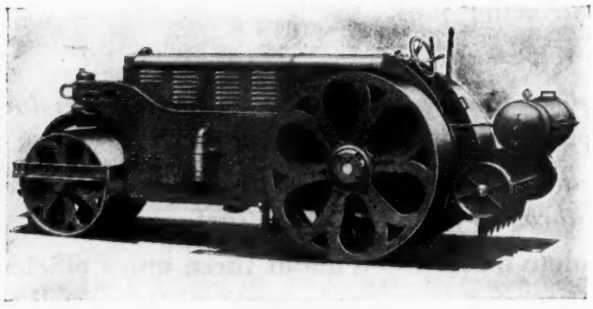

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inches and ¾ gallon per square yard of bituminous material is applied and mixed with the gravel. Our experience to date has led us to prefer the use of tar with gravel, and of asphalt with broken stone. Tar of 20 to 30 viscosity is used. Some gravel has been used as it came from the bank, without even screening, but better results are obtained by separating the sand from the stone and recombining in definite proportions on the road. The more closely the gravel meets the requirements for Class A concrete, the better a mixed-in-place road it makes. A reasonably hard stone, cleanliness of sand and a high fineness modulus are essential.

After applying the bitumen, thirty per cent of sand is added and mixing begins. For this purpose we have developed a wooden drag 20 ft. long with steel blades in zig-zag arrangement. At the conclusion of the mixing it is advisable to use a grader to smooth the occasional ridges that the drag is likely to leave when such a depth of material is mixed. The surface is then given a limited preliminary rolling immediately. The seal is postponed if possible until the end of the job, when one-fourth gallon of tar is applied and covered with gravel and sand up to ¾-inch maximum size. This is smoothed with a drag of woven wire and rolled.

In the re-treatment of our old bituminous-treated gravel roads, the use of a zig-zag drag has produced a wonderful improvement in their riding quality, and has also reduced the cost of maintenance by making the surface more durable.

Broken stone bituminous surfaces are mixed and smoothed by the use of a power grader with a wheelbase of about 18 ft. The maximum size of stone is nearly the depth of surface desired, which is either two or three inches. The stone is spread by spreader boxes and cut-back asphalt is applied in two applications, the stone being mixed by windrowing after each application. Following the second mixing, it is spread smooth and immediately given a limited preliminary rolling. A cut-back asphalt with a viscosity Engler at 50° C. of 150 to 175 and a penetration of the residue of 90 to 100 has proved most satisfactory. For a two-inch surface a total of 0.85 gal. per sq. yd. is required in the mix.

We have also built some low-cost broken stone surface using a penetration emulsion. The stone was spread by spreader boxes and smoothed by a grader and the asphalt was applied in three applications, successively keyed with chips and rolled. On the final covering, the chips were smoothed with a drag. A light paint coat will then hold the chips in place, giving the smoothness of a dragged surface.

The seal coat we have developed for our mixed-in-place broken stone roads has also been used on our hot penetration roads, and we have found that it may likewise be used to make smooth our old macadam roads and thereby add years of useful life to them.

In the construction of this seal, a prime coat of cut-back asphalt is applied to the surface at the rate of one-fifth to one-fourth gallon per sq. yd. A layer of chips ¾-inch deep is spread immediately over the prime coat, and is covered with another application of one-fourth gallon per sq. yd., and mixed and smoothed by the drag and immediately rolled in place. The blades of the drag are set ¼ inch higher than the shoes. By this method all the irregularities in the surface are filled with coated chips, there is no loss of chips and the surface remains smooth, uniform and non-skid, because all the chips, being coated with asphalt, remain where they are placed.

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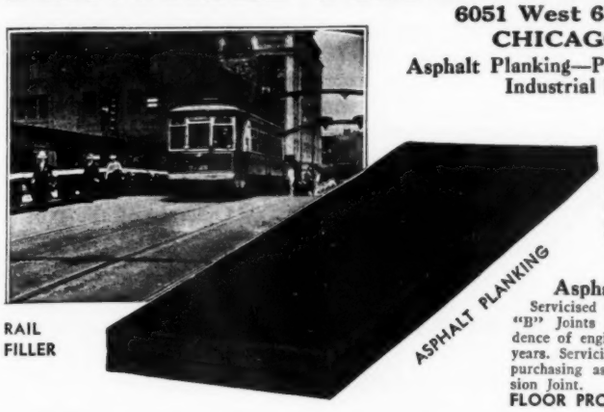

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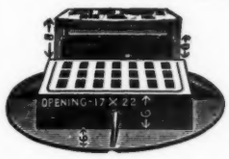

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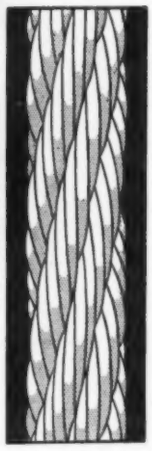

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We used this type of seal on two hot penetration jobs this year, but with a larger stone, from ½ to 1 inch, which, of course, required more asphalt. An Adams re-tread mixer was used instead of the drag. The result was an excellent non-skid surface texture. This seal was also applied with good results on an old macadam surface and we expect to smooth several old macadam roads with it next year.

[Condensed from paper before the 1932 meeting of the Association of Highway Officials of the North Atlantic States.]

Dust Treatment With Oil and Calcium Chloride

The Indiana Highway Commission continued, during 1931, its policy of treating a large mileage of stone and gravel roads with oil and calcium chloride. During the year 574 miles of road were covered with an oil mat; 251 miles were treated with light oil as a dust palliative and 15 miles were treated with calcium chloride.

The roads treated with calcium chloride are made comparatively dustless for about four weeks after each treatment, but by the use of three and sometimes four treatments during the dry season the dust is kept to a minimum so that it is not a serious menace to traffic.

The roads treated with light oil as a dust palliative are likewise not entirely dustless, but the dust nuisance is so greatly reduced that it is not seriously objectionable to traffic. The elimination of the muddy, sloppy condition after wet weather and during the spring season is as great an advantage to the traveling public as the elimination of the dust during the dry season. An automobile driven over an untreated road is so splattered with mud by the present high speed traffic that it requires washing after each trip. The saving to the car owner by eliminating this washing is a large item on the up-keep of a car.

These oil treatments not only reduce the dust nuisance but they serve as a protection to the road surface. The oil fills the small voids in the surface, making it more impervious to the softening action of water. The cutting up of the surface and washing away of the aggregate is reduced very materially.

Although the treating of roads with oil is somewhat objectionable, the use of quick-drying asphalt or tar has eliminated most of the complaints from this source.

The dust palliative treatments, while quite effective, are not entirely successful because of the continued expense of heavy dragging and the necessity for adding fresh aggregate to the surface to prevent pot holes from forming. If more oil and aggregate are used, an oil mat is produced which makes a surface entirely dustless and free from slop and mud during wet weather.

The oil mats are only about one inch in thickness. Ordinarily they are expected to break up in many places during the spring season where the foundation of the road is weak. However, this past spring very little breaking occurred because of the unusually dry fall and winter. Many of the oil mats came through the spring season in practically as good condition as they went into the winter. This was an unusual condition which ordinarily can not be expected. Where

the oil mat surfaces do break, they can be scarified, leveled and another treatment applied at a very nominal cost, which will again make a good riding surface. After each treatment a better surface should be formed than in the preceding year.

Segregation of Water in Concrete Placed in Deep Forms

It is well known that during the continuous placing of concrete in deep forms such as columns, piers, abutments, retaining walls, etc., there is a tendency for water within the concrete to rise as the form is filled. This results in an accumulation of excess water in that portion of the concrete at and near the upper surface of each continuously placed section, with the consequent formation of layers of relatively weak, porous concrete at the fill planes. It is a matter of common observation that such concrete, when exposed to the weather, deteriorates much more rapidly than the adjacent concrete at the bottom of the next lift. It has been generally assumed that this difference in the rate of weathering is due in large part to excessive water, generally known as water gain, although little or no data have been published which show quantitively either the actual effect of water gain on strength and durability, or the relative influence of various factors such as grading of aggregates, consistency of concrete, area of section, method of placing, tamping, etc., on the extent to which water gain takes place.

The problem appeared to the Bureau of Public Roads to be of sufficient interest to justify a preliminary series of tests under certain job conditions to determine the extent to which water gain developed and its effect upon the quality and uniformity of the concrete.

It was not possible to cover a wide range in test conditions; and the applicability of the data is restricted to the conditions under which they were obtained. While forms of different heights, ranging from 3 to 12 feet, were used, they were all of one width, 8 inches. Methods of placing included both spading and vibrating. (Electric vibrators were used, loaned by the Electric Tamper & Equipment Co., Ludington, Mich.) The fine aggregate used was a relatively fine sand. The consistency of the concrete was varied from 2 to 8 inches slump. A total of 33 columns were cast.

Samples were taken from each column 1 to 1½ hours after the concrete had been placed, and after it had hardened cores were drilled. A 1:2:4 dry-rodded mixture, using river sand and gravel, was used throughout.

The conclusions derived from this study are naturally restricted in their application to conditions comparable to those under which the tests were conducted. The conclusions are:

1. No serious segregation of concrete or water gain took place. This conclusion applies for a range in slump varying from 2 to 8 inches and for both the spading method and the vibratory method of placing. In this connection, attention is called to the fact that forms only 8 inches in width were employed in these tests and also that a relatively fine sand was used. Both of these factors probably contributed considerably to the absence of serious segregation.
2. With the exception of the one series of tests in

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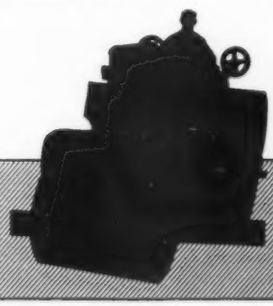

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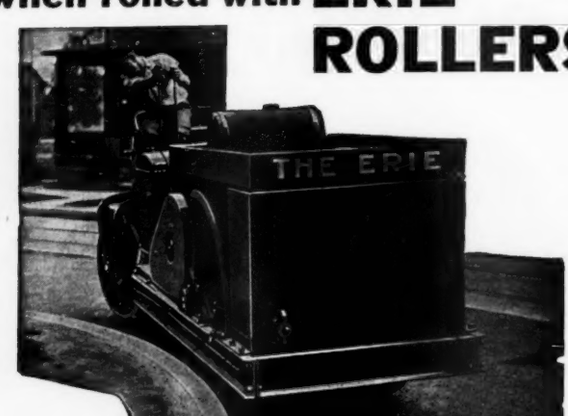

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which the concrete was both spaded and vibrated, the method of placing by vibration produced concrete having about the same average strength and uniformity as similar concrete placed by spading.

3. A combination of spading and vibration appeared to increase the strength of the concrete considerably beyond the strength obtained by either spading or vibrating alone.

4. With the exception of the same series of tests, the average strength of concrete as determined by cores drilled from the columns was approximately the same as the strength of the concrete determined by tests on samples taken as the mixer was discharged.

5. The net water-cement ratio taken approximately one hour after the concrete had been placed averaged about 0.1 less than the net water-cement ratio at time of mixing.

Consolidation of Counties for Road Work

"There is an adjustment which can and must be made in the management of finances for rural roads," said Thos. H. MacDonald, Chief, U. S. Bureau of Public Roads, in an address before the American Road Builders' Association. "Improved methods of travel and the development of equipment capable of much greater production both in construction and maintenance indicate the desirability of consolidating the smaller road units into larger single units. In some sections it would possibly be sufficient to consolidate all units under the county. In others, a number of counties can be consolidated into one district. There has already been progress in this direction, and a considerable number of states have extended their facilities for direct or general engineering supervision and administration as well as financial help. There are many counties where the road problem is sufficiently large that the road organizations should be maintained; to attempt to place all of these counties under a single state administration would make an unwieldy and inefficient machine. But there is no doubt that through cooperation between the state highway departments and the county engineering units, a correlation and unification of results could be secured at a lessened cost. We have more than 3,000 counties in the United States. A large number of these could be consolidated for road purposes, at least, with a resultant lowering of overhead costs and the doing away with inefficient administrative boards. Only such a reorganization can effectively increase the field for efficient and economical engineering and contracting in the building of local or secondary roads."

Marking Highways in Indiana

Centerline Marker. A number of different designs of centerline markers have been made and used on Indiana highways. It is believed that the most practical design consists of a self-driven vehicle with about 30-in. tread and 20-ft. to 25-ft. wheel base. The driver is able to keep a straight line by the use of two small rods over which he sights down the center of the road. Such an outfit permits two-way traffic to operate unmolested and thus reduces to a minimum the crossing of the freshly painted line.

Material Used and Season of Year. Heretofore, much of the centerline marking has been done during warm weather as it was believed that the bituminous material or white paint used would give better results

when applied at that time. Experience would indicate, however, that the heavy cut back asphalt, designated in specifications as liquid asphalt CB, gives better results when applied to the dry pavement at an air temperature below 40° F. At this cool temperature, it is not necessary to apply any covering material, thereby effecting quite a saving in cost. Application at this low temperature usually necessitates that the work be done in the fall after November 15 or in the early spring before April 1. If the bituminous material is applied during warmer weather, it is necessary to apply a covering of grit to prevent it from smearing and tracking over the surface.

White paint which is only used on the black surfaces gives better results when applied in reasonably warm weather. A black centerline has even been used on some of the bituminous surfaces with very satisfactory results. Although the bituminous pavement is also black in color, the black centerline usually shows up well after night and even in daytime, due partly to the elevation of the mark above the adjacent surface.

Cost of Marking and Signs on State Highways. The expenditures for marking and signing, including the erection of signs and markers on state highways and detours, marking on pavements and white washing, for the past seven years is as follows:

Year	Mileage of Roads	Cost	Average Cost Per Mile
1925	4,258	$27,930.48	$6.56
1926	4,591	20,546.13	4.48
1927	5,173	92,860.09	17.95
1928	5,875	50,532.06	8.63
1929	6,696	55,355.94	8.27
1930	*7,322	69,616.30	9.52
1931	†7,650	83,922.96	10.97

or averaging $57,251.99 per year or $9.51 per mile.

* The above includes 1,344 miles of detour roads.
† The above includes 916 miles of detour roads.

The above costs do not include such costs as the transporting of the signs and posts, and the cost of hauling the men to and from their work.—*1931 Report, Indiana Highway Commission.*

An Outstanding Highway Bridge

Our cover photo this month shows the Cornwall Bridge, between Cornwall and Sharon, Connecticut. The original was furnished us through the kindness of C. G. Nichols, executive secretary of the Connecticut State Highway Department.

There are five open spandrel arch spans of seventy-eight feet and one of one hundred eighty-four feet (on center lines) crossing over two highways, the New York, New Haven and Hartford railroad and the Housatonic river.

The total length of the structure is 746 feet 7 inches, with a clear roadway width of 33 feet. The highest point on the roadway is 53 feet above the water level and 78 feet above the lowest footing. As near as can be ascertained, Cornwall bridge is the longest all-concrete grade separation in New England.

All of the engineering and architectural details, together with the field engineering, were handled by the personnel of the Connecticut State Highway Department. It was designed by John F. Willis, with checking and assistance by J. W. Cross, L. D. Webb and A. F. Rakatzky under supervision of L. G. Sumner, then chief draftsman. E. C. Welden was deputy commissioner and John A. Macdonald, commissioner. Harry C. Orr was resident engineer. C. W. Blakeslee and Sons built the structure and Bertolini Bros. the approaches. The total cost of project was $488,296.67.

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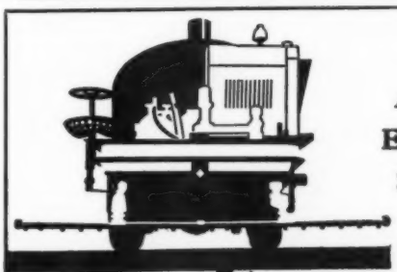

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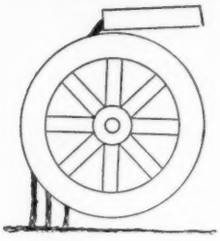


By
Jack J. Hinman, Jr.

The essential features of important articles of the month having to do with water works designs, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

IN one of the outstanding articles published recently,[161, 165] Caleb Mills Saville puts forward as his main thesis that **upland waters of unquestioned purity** should be secured for water supply wherever it is physically possible to do so. Only in places where it is manifestly impossible to secure pure upland waters, should water treatment be resorted to, in Mr. Saville's judgment. Unfortunately there are many places where upland waters are not available within the limits of economic feasibility and where the impounding of waters, when attempted, yields only farmland drainage of inferior sanitary quality. Such water must be put thru processes of treatment quite as effective as those used in the treatment of river waters. On the other extreme from sources of great purity are such available waters as that taken from the foul Whangpu river by the **Shanghai water works**[53] and turned into potable water by modern water purification methods.

Where **dams** are used for impounding waters to be used in securing a water supply, **rainfall studies** and careful estimates of yields[108] must be made. **Geological studies** to insure the stability of dams[140] are required and effort must be made to prevent leakage and damage to the structure. Pollock[27] claims that the **quick hardening cements,** higher in alumina than the more commonly used types, are especially desirable in concrete dam construction in spite of greater cost, because the material is less porous and because it is more resistant to the **humic acids** of moorland waters. Griffin[25] has recommended facing concrete structures with glazed tile to reduce the penetration of water and consequent damage by **alkali waters** or by **low temperatures.** At Colorado Springs[51] **steel plates with welded joints** were used to seal a rockfill dam. At LeRoy, New York,[n54] leakage in an earth fill dam was caused by an **agricultural drain** under a dike at one end of the dam. This tile had not been discovered and removed when the dike was constructed.

An echo of the World War is heard in the article on the water supply of **La Rochelle, France,** by Maynard[135]. One of the problems involved was the reclaiming of the well at Périgny which had become salt by the **invasion of sea water,** said to have been due to extremely heavy pumping by American troops. Simpson[164] describes the process of developing a water supply from wells in the valley of the Souris river for **Minot, North Dakota.** Usually the **temperature** of the water yielded by a well from twenty to sixty feet deep is two or three degrees Fahrenheit above the mean annual temperature for the region[75]. This relatively low temperature makes the well water especially agreeable in the warm weather of summer, and it also is important in connection with the use of well waters by **refrigerating plants** in cooling compressed gases. Interest in **water divining** continues to yield letters expressing definite disbelief or faith in the mysterious working of the dowser's practices[32, 34, n64].

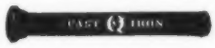
In view of the importance of the **inspection of cast iron pipe** before shipment from the works, Digby-Smith[98] regrets the fact that some cities in Great Britain have discontinued the practice as an economy measure. He points out that discontinuance of the inspection is apt to prove to be very unwise. Some communities have the inspection conducted by their own engineer, others by an inspection organization, but the work can be entrusted to an instructed junior engineer. **Lincoln, Nebraska,** has recently let a contract for a 36-inch cast-iron pipe line twenty-five miles long to cost $1,309,000[55]. Cast iron pipe laid in **San Francisco** in 1859 was found to be in good condition when uncovered recently, thus furnishing another evidence of the long service which this material is capable of giving. **Gate valves** should last as long as the pipe line itself in the opinion of Angilly[88], who has assembled much useful information about them. **Surveys of trunk mains** by Wilson[87] have shown that poor maintenance and inspection of gate valves have frequently resulted in unfavorable flow conditions in water distribution systems.

Niemeyer and Bruhn[83, 157] show that all of the trouble with poor pressures in the homes of customers may not be due to the condition of mains, but that the **services and house plumbing** may be to blame. In Indianapolis in 1931 about 60% of the inquiries about water pressure were found to be due to matters under the control of the consumer, such as inadequate main line piping in the property, defective water heaters, furnace coils, softeners, valves and fixtures. About 25% was the result of obstruction in the corporation cock, curb cock, service line, meter yoke or meter, while the remainder of the trouble was due to a combination of small inside piping and inadequate service line. Giesecke and Badgett[77] have recently reported on **loss of head** in **copper pipe and fittings** of ¾, 1, 1¼ and 1½ inch diameters such as are now being used in services and in some inside plumbing. Several papers on **corrosion** appeared during the month. Most of these considered iron pipe, but a German article by Haase[60] also discussed the corrosion of aluminum, lead and copper. Evans[33, 35, 43] gave an excellent review of the status of corrosion prevention.

McDonnell[160] continues the discussion of the economy of **Diesel engines** in water works practice begun last month, and Von Widdern[145] continues his discussion of the **testing of centrifugal pumps.** Very definite guarantees of efficiency with a suction lift of 18 to 20

★ *"Maintenance costs where the Two-Main System is used are lower than where the old system is used."*

IN A BROCHURE about the Two-Main System, sent upon request, the subject of savings on cost of street openings and in service maintenance is presented as follows: "Maintenance costs where the Two-Main System is used are lower than where the old system is used. Leaks caused by traffic shocks are practically eliminated and such leaks as do occur are easily found and the fact that no pavement need be dug up or repaired materially lessens the cost of each repair job. In this connection should be considered the added cost, due to traffic, where openings must be made in pavements. The necessity for men to warn traffic, the cramped quarters, the danger of accident, the necessity for working overtime and at night, and other elements, add to the cost of work done in main thoroughfares. Another item of cost is the need of maintaining services that have been laid prior to pavement construction and have not been used. With the Two-Main System, only such services are laid as are actually to be used."



★ Excerpt from "The Two-Main System of Water and Gas Distribution," a brochure issued by THE CAST IRON PIPE RESEARCH ASSOCIATION and sent upon request to interested engineers. Address THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, Research Engineer, 309 Peoples Gas Bldg., Chicago.

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feet were required in the specifications for centrifugal pumps for **Kingston, Ontario**[14], but Austin states that the demands were amply met. McFee[104] gives a special discussion of **suction lifts** and a series of replies to questionnaires[103] advises how to protect the pumps from injury due to their **running dry.** The development of **turbine well pumps** is sketched by Conant[18].

Papers on water purification discuss **taste and odor** improvement chiefly this month. Both Baylis[84] and Waring[12] present useful summaries of recent work. Thuma[89] found **aeration** by compressed air useful at St. Paul. Baylis[155] and Miyamoto[23] have discussed aeration from the theoretical side of the question. Marquis[94] was pleased with the reduction in **filter clogging** which he obtained when the growth of algae in the Spartansburg, S. C., water supply was counteracted by copper sulfate treatment. Ventre[95], at Monroe, Louisiana, obtained improved results in **coagulation** by the use of ferrous sulfate, lime and chlorine. While not dealing directly with the motion of sand in filters, the studies of **sand movements** conducted by Takobeya and described by Jenkin[41] may prove to be suggestive. Movements of the sand bed, as a wall was moved away, were made visible thru a glass plate by the building up of the sand bed with alternate layers of equal depths of white and black sands.

Nordell[7] discusses the advantages of **zeolite treatment** of water which has lately come into more general use in municipal plants in the country. The Hooton pumping station plant of the West Cheshire Water Company in England has used the zeolite softening process with success for eighteen years[138]. It has used one of the older types of synthetic zeolites and has reduced 750,000 Imperial gallons of water from 20 degrees of hardness to 10 degrees daily with no replacement of the zeolite and without any noticeable loss of the mineral. The needs of the **paper industry** for water are described by Booth[148]. Since from 20 to 1000 pounds of water are used for each pound of product, the importance of the character of the water becomes understandable. Halifax, in the West Riding of Yorkshire, is claimed[n131] now to have the **largest pressure filter installation in the world.** The plant, located at Thrum Hall Lane, has 84 units of Paterson pressure filters 9 feet in diameter, with a combined capacity of 12,000,000 Imperial gallons per day.

The **Detroit Water Board** has had to drop 130 men from its payroll on May 3rd[n48]. This was about one-third of the salaried staff and included important members of the engineering constructional organization. Shrinkage of revenues was the reason given. The prospects for **water works construction in Canada,** especially in Ontario, seem to be promising[29].

An interesting paper on the importance of **salamanders** to water hygiene, especially that of **spring waters,** was published by the American Museum of Natural History in its paper, "Natural History"[100]. The work was done in the vicinity of Olean, New York, by Hassler. The salamanders were found to be able to penetrate deeply into crevices about springs and to give off organisms of the colon-aerogenes group of bacteria into the water. The type of organisms excreted seemed to be the same as those ingested by the salamanders in eating fly eggs and larvae and similar matters. The protection necessary to springs used for water supply is shown to require more care and study of methods for the exclusion of salamanders than has been given to it heretofore.

Bilharziasis, or schistosomiasis, as a result of infection by the Schistosomum mansoni, is prevalent in the island of St. Kitts, British West Indies, among certain classes of the population, according to Jones[97]. Its connection with drinking waters, bathing in streams, and the native practices of washing clothing in streams are well discussed. Wild green monkeys, as well as man, act as carriers and complicate the problem of control of the disease. Planorbid snails are numerous and act as intermediate hosts. **An investigation of the cause of death of salmon and sea trout smolts** in the estuary of the river Tees[9] indicated that tar acids and cyanides were chiefly responsible. It is interesting to note that Marco Polo[n171] in the latter part of the thirteenth century reported goiter in one region to be due to some quality in the drinking water consumed.

Chironomous larvae have caused annoyance at Cincinnati[85] and at Hyattsville, Maryland[86], recently. These larvae are often of a bright red color, very active and easily noticed. Consequently they are apt to alarm persons who find them in drinking water. Since they come from eggs laid by the mother insect—a **midge or gnat**—on the water surface, the presence of these organisms is not evidence of pollution of the reservoir by surface drainage. Nevertheless one of the press agencies widely distributed the statement a few months ago that a large number of people had been made ill at **Santa Paula, California,** by water "which showed the presence of the larvae of a midget fly." Probably some other cause was actually to blame.

In connection with the numerous reports of the 52nd Annual Convention of the **American Water Works Association** at Memphis, during the first week of May, the paper of Miss Jane H. Rider, of Arizona[93, 153], on the value to operators of national and local gatherings of this sort is most timely. Miss Rider, who is well and favorably known to workers in the field of sanitation, is firm in her belief in these meetings as places where **up-to-the-minute information** on technical and practical matters may be obtained. Those who were able to attend the Memphis meeting and who enjoyed the hospitality of **Mr. James Sheahan,** general superintendent of the Water Department, and that of the city, will learn with sincere regret of the death of Mr. Sheahan on June 9th. The fine new plant at Memphis has been named the Sheahan Pumping Station as a testimony of the appreciation by the community of the work which Mr. Sheahan had accomplished during his long period of service.

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(Continued on page 57)

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Sanitary Engineering

Some Ammonia-Chlorine Experiences

WE HAVE recently examined replies made by a considerable number of water works engineers, superintendents or other officials to inquiries concerning their experiences in the use of the ammonia-chlorine process. In order to better insure receiving full replies, assurance was given that the identities of the cities reporting would not be revealed.

Ammonia-Chlorine Ratio

Practices as to ratio of ammonia to chlorine varied widely—from 1:1 to 1:8. In most cases of high chlorine ratio the chlorine is applied both before and after filtering; in the 1:8 case, 6 parts of chlorine and 1 of ammonia were applied as pre-treatment, and 2 parts of chlorine after filtering.

Several endeavor to adapt the ratio to changing conditions. One city applies 1:3 before coagulation and 1:4 to the filtered water in summer; while in winter it applies 1:2 before coagulation and none to the filtered water; 1½ to 3 pounds of chlorine per million gallons giving a residual of .16 to .24 in the water applied to the filters and .08 to .12 in tap water at the plant. The higher summer dosage apparently is employed, partly at least, because of algae tastes.

Another city, treating for both chlorine and algae tastes, has varied the ratio from 1:1 by steps to 1:3 and settled upon 1:2 as "effective but not wasteful."

A city which uses water from a mountain supply studied the subject quite thoroughly and decided that 1:4 was adequate if the mixing were thorough, but that 1:3 was better if either the mixing or contact period for the ammonia were inadequate.

A city with a surface supply carrying B. Coli varies the ratio with the water temperature at the intake, ranging from 1:2 to 1:5; 1:4 is used for slightly above 32°. The aim is to maintain a residual of 0.05 in the distribution system.

One superintendent stated that he ordinarily used a 1:3 ratio, but that when heavy rains brought decayed leaves and half-digested excreta to the intake the ratio was changed to 1:5 because these matters contributed an unusual amount of ammonia to the water.

Maintaining Residual Chlorine

All reports agree on the decided effect of the ammonia in maintaining residual chlorine for comparatively long periods. Several believe that its use is warranted by this result alone, even though there were no others. One cites an instance when the water of his city, which contains a chlorine residual of 0.3, accidentally received a small amount of polluted water, but the mixture complied with bacteriological standards for potable water, which it would not have done had there been no residual chlorine.

One superintendent stated that the supply is taken from an open stream, carried through 20 miles of pipe and discharged into a reservoir which gives two weeks' storage. Ammonia and chlorine, 2:5 ratio, are introduced at the upper end of this pipe line and excess chlorine is found at the outlet of the reservoir.

Another reports a 1:4 ratio giving a residual after about 40 hours, varying slightly with the temperature.

An unusual argument for residual was given by one water works manager, who believed that many of the positive B. Coli returns from tap samples sent to the State laboratory for analysis before ammonia was used were due to carelessness in taking samples, which the residual overcomes.

In one city a slight residual is found at all times, even at taps removed three days' flow from the point of treatment.

A residual of 0.15 to 0.25 at all points in the distribution system ten days after treating with 0.6 p.p.m. of chlorine and 0.23 of ammonia is reported from one city.

Lag in Sterilization

One city reports that while chlorine used alone was practically instantaneous in action, since ammonia was added agar plates show a progressive decrease in colonies from raw water to tap water, "indicating that our 6 to 12-hour contact period in the plant is none too long for safe use of chloramine." Another reports 1½ hours sufficient.

Lag is considered by one city to make the use of ammonia impractical at one of its pumping stations, since consumers' service pipes take off of the main within a block of this station.

In one city where the raw water $_{p}H$ averages 7.5 and that of the treated water 7.8, no appreciable lag is noticed; possibly due, it was suggested, to the high $_{p}H$.

An engineer connected with one plant believes that it is inadvisable "to employ the ammonia-chlorine treatment on highly contaminated water unless a strong residual (0.15 p.p.m. or higher) can be maintained in the water undergoing treatment for at least two hours before delivery is made to the consumers."

One laboratory director reports that "there is a definite lag period, depending upon the concentration of the pollution encountered; and that this lag period can be overcome by increasing the quantity of chlorine used."

Tastes Due to Algae

A majority of the cities that reported on this feature stated that the ammonia-chlorine treatment has re-

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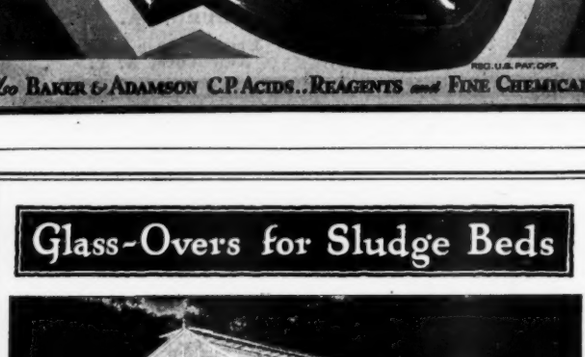

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moved or diminished taste due to algae or to vegetable matter in swampy land; others, however, found little or none of such effect.

One reports that pre-chlorination with ammonia "has been very effective as an algaecide, especially in the mixing and settling basins." Another that its use "as an algaecide is satisfactory except in extreme cases." In another city "the algae produced a very pronounced fishy or cod liver oil taste. This taste disappeared within about six hours after commencing the addition of ammonia to the chlorine treatment which was already in force." A manager reports that the use of ammonia helps eliminate some of the tastes caused by "vegetation and organic matter in the river, particularly during very low water periods in hot weather."

In one case where algae shortened filter runs and caused repulsive tastes, copper sulphate and bleach failed to cure these troubles, but shortly after introducing ammonia-chlorine ahead of the low-lift pumps (6 lbs. and 2 2/3 lbs. per m.g.) the odor disappeared and the filter runs were greatly lengthened.

In another case it proved quite effective as an algaecide, but left a very disagreeable taste in the water, which was removed by activated carbon. The engineer of another water department, after extensive experimenting, concluded that "ammonia does not destroy taste and odors but prevents their formation. It is not efficient in the prevention of marshy, river, woody and muddy tastes which usually accompany high turbidities in the raw water and are present in the water before chlorination." This plant substituted powdered activated carbon for pre-chlorination and "an excellent water has resulted, free from all tastes and odors at all times."

One superintendent had not been able to "control the algae entirely but had retarded its growth to a large extent" and the reservoirs no longer took on a "green murky cast." Said another: "Our problem is to kill the algae so that they may be coagulated by the alum and removed during coagulation and filtration. This the ammonia-chlorine process will not do." The most helpful treatment he found was pre-chlorination, using 20 to 28 lbs. per m. g.

This treatment was found "particularly valuable for controlling growth of iron bacteria or other objectionable organisms in the distribution system" of one of the cities.

Cost of Water Works Chemicals

Columbus, O., used last year, for softening and purifying its water supply, lime, soda ash, alum, chlorine and coke, the cost of which averaged $12.35 per million gallons of water treated. The average costs per ton of these materials, f.o.b. Columbus, in 1931, were as follows; Lime—$5.71. Soda ash—$22.59. Liquid chlorine—$87.50. Coke—$4.70. The alum was made at the plant and cost $10.28 a ton; the materials used being sulphuric acid at $12.50 per ton, and bauxite at $12.96 per ton.

All of these prices were less than formerly. Lime cost $6.49 in 1930 and $12.05 in 1921. Soda ash cost $27.00 in 1930 and $42.54 in 1921. Alum cost $11.22 in 1930 and $13.39 in 1921. Chlorine cost $163 in 1930 and $112 in 1922, the first year it was used. Coke cost $5.00 in 1930 and $5.79 in 1927, the first year it was used.

All Sewage Solids Burned

LONDON, Ontario, has nearly completed a sewage treatment plant which contains several features of unusual interest. One of these is the step-by-step construction, which began in 1927 and will probably be completed this year; each unit being operated and tested before the next was built. But perhaps the most important is the aim to dispose by incineration of all the solids removed from the sewage—screenings, grease and sludge.

This plant, known as the West End plant, is one of three treating the city's sewage. The total population of the city is about 73,000, and the total maximum sanitary flow about 7,000,000 g.p.d., of which this plant treats about 4 m.g.d. from about 50,000 connected population. Considerable of the sewage reaching the plant is pumped by a large pump operating intermittently, causing the rate to reach and at times exceed 5 m.g.d., but it is proposed to avoid this by substituting for the large pump a small one that can operate almost continuously.

In 1926 W. M. Veitch, engineer of sewage disposal of London, began testing out a plan of removing the activated sludge solids by mixing such sludge with raw sewage and passing the mixture through fine screens. He found that most of the solids of the activated sludge adhere to the grosser solids of the raw sewage and are screened out with them. If some sludge passes the screens, it but adds slightly to the amount of activated sludge intentionally added to the raw sewage.

The screenings from the fine screens, as well as from the bar screens, and grease from the grease trap, all are burned together in an incinerator. The ash from this and sand from the grit chamber are used for fill. The effluent from the sedimentation tanks is discharged into the Thames river, as is also the occasional excess over the tank capacity of 5 m.g.d., such excess being first passed through a storm tank.

General Description of Treatment

The general treatment is as follows: The gravity sewage enters the plant through a 48″ sewer and the pumped sewage through a 20″ sewer. When the combined flow exceeds 5 m.g.d., the excess is diverted at this point to a storm tank, the effluent of which goes to the river, while the sludge is returned to the main flow just below the grease tap.

From the diversion weir the main flow passes into a grease trap. The grease from this passes through a press and is charged into the incinerator. The grease trap effluent, after receiving the sludge from the storm tank, passes through a grit chamber.

The grit from the grit chamber is washed and used for fill. The effluent receives the excess activated sludge and passes through a bar screen, and from this through a fine screen.

The screenings from both bar and fine screens will be pressed to remove part of the water and burned in the incinerator. The effluent receives the necessary return sludge and passes to the aeration tanks. The effluent from these passes through the sedimentation tanks.

The sludge from sedimentation tanks is returned, part of it above and part below the fine screen, as already described. The effluent is discharged into the river.

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In this process the fine screening is a critical feature. It takes only a little disturbance to dislodge from the screen the activated sludge that has accumulated there. Mr. Veitch studied the various types of screen and finally selected a panel type known as the Hankin fine screen, in which six screens, each 5 ft. wide by 18 in. deep, are set radially around the circumference of a drum. Each screen is made of ⅛" square mesh galvanized iron wire, reinforced with ½" steel wire, held in a heavy steel frame. The edges of the panel are fitted with rubber, making close contact with the sides and bottom of the channel so that all sewage must pass through the screen. The drum revolves slowly, and the screenings on the rising panels drain off much of their moisture, and on reaching the top are jarred off into a hopper. From the hopper the screenings, having about 87% moisture, are carried by a screw conveyor to wire baskets, where they are drained further and then placed in the incinerator.

Experiments are being made with pressing the screenings in a perforated wrought iron pipe. The screenings are fed into this pipe from a hopper placed near one end of it, and pushed forward by a piston moving slowly with a short stroke. The other end of the pipe is tapered to a reduced section and pressure is exerted by the piston in pushing the screenings through this tapered end to the outlet, thus squeezing out part of the water, which is returned to the main flow above the screens. Further experiments are being made to determine the best size, taper, length, etc., of this pipe press. Using a pressure not exceeding 1½ tons, the moisture content has been reduced from 87% to 75%.

The Incinerator

The incinerator has been operating for more than three years and has proved that, once started with fuel, all the screenings can be burned without additional fuel. However, if unpressed activated sludge is mixed with the raw screenings, great care in stoking is necessary. The incinerator has a fire grate area only 3 feet square, with a drying hearth 4 feet square back of it. Screenings are dumped onto the drying hearth and drawn forward onto the fire by hand. At night a charge of screenings is left on the drying hearth to be used in starting the fire the next day. The chimney is 4 ft. diameter at the base and 45 ft. high. A ¾ h.p. blower provides forced draught when needed occasionally. It is expected to burn ten tons of wet screenings a day.

The cost of the plant has been $54,557 for preliminary treatment, works, administration building, operator's residence, etc., which were completed before 1930; and $107,172 for the aeration, reaeration and settling tanks, including piping, compressors, pumps, housing, etc.; and it is estimated that $54,450 will be needed to complete the plant. This total of $217,000 is at the rate of $43,400 per million gallons, or $4.34 per capita of connected population.

The plant is being operated with four men. It is estimated that the power will cost $2,500 a year. Including 10% for interest and depreciation, the estimate of annual cost is $29,000, or 58 cts. per capita per year, or about $20 per million gallons treated.

Garbage Incineration in Two Cities

Philadelphia last year disposed of about 48% of its garbage on farms, 45% by reduction and 7% by incineration. The amount incinerated in 1930 was 13,813 tons, part rubbish, no fuel being required. For this, the cost of operating the incinerator was $62,761

(about $4.54 per ton) of which $52,159 was for labor and superintendence and $10,512 for upkeep and repair. Collecting cost about $5.00 a ton.

St. Petersburg, Fla., has a population varying widely in different seasons and "per capita" figures mean little. The amount of garbage collected totals about 19,000 to 20,000 tons a year. It is burned in an incinerator, using sawdust collected from mills as fuel. The garbage is required to be wrapped. The cost of operating the incinerator in 1930 was $13,462, which included $10,903 for labor at the incinerator and superintendence, and $2,559 for upkeep and repairs. Collection cost $1.70 per ton.

Forecasting the Trend of Sewage Treatment

By Waldo S. Coulter

Twenty-five years ago, the two-story tank was a new arrival. The mechanical removal of sludge from sewage settling tanks was represented by a few inconspicuous British devices, used in conjunction with chemical precipitation. Chemical precipitation had about had its day and was practically confined, in the United States, to Providence and Worcester. Electrolytic treatment was active and there were those who believed that it might indicate future developments. Mechanical cleaners for sewage racks were not uncommon and fine-mesh belt-screens were in use in Europe. The Weand screen at Reading was installed some years later.

Specific devices for the removal of colloids were practically confined to the Travis "colloider," and the necessity for aerobic conditions for colloid removal was not recognized. The separate digestion of sludge lay in the future and that handy working tool, the pH value, was unknown. Experiments had been made with calcium hypochlorite to disinfect sewage, but knowledge was confined to its effects as a bactericide.

The activated sludge process was as yet behind the curtain. In secondary treatment, the contact bed still occupied a prominent position, but the trickling filter was the principal device employed for secondary treatment. Intermittent filtration through sand was about twenty years old.

Looking back, it would seem to have been impossible for anyone to have successfully outlined the future trend of sewage treatment. To forecast the future today is probably equally impracticable.

It does seem, however, that settling tanks, drying beds, and conditioning and dewatering by filters may be replaced by continuous mechanical centrifugalization. Mechanical colloid removal may be a possibility. This would speed up bacterial action. Whether the latter will be relegated to limbo is anybody's guess.

No Unfiltered Surface Supplies in Georgia

With the construction of a plant for purifying the water supply of Manchester, Georgia, "there will be," says the Georgia Dept. of Public Health, "no unfiltered surface stream water supplied to any municipality or community in Georgia." It is expected this plant will be in service by fall.

The Manchester water is now from deep wells and has a very high iron content. A new supply will be obtained from a stream, and will be treated with aeration, coagulation, sedimentation, filtration and

Pouring two pipe sections on job in Boro of Richmond, New York City. When using Ex-XL-cell two or more sections may be poured outside the trench, thus saving labor in restricted trench space.

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Ex-XL-cell being used in Union County, New Jersey. Notice the fill at top of picture. When Ex-XL-cell is used, trenches may be back filled as fast as pipe laying progresses as compound sets immediately.

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sterilization. The well water will be retained as a supplementary supply. The capacity of the plant will be one-half million gallons per day. By using a covered concrete reservoir, already in use, as a clear well, the cost of the new rapid sand filter and iron removal plant will not exceed $14,000.

Economical Refuse Collection in Sioux City

In spite of the depression, the Department of Sanitation of Sioux City (population 80,000) collected more garbage and more rubbish in 1931 than in 1930, but collected it with a less total expenditure. The total expenditure in 1930 was $50,816 and in 1931 was $50,485.

The 1931 total included $49,904 pay roll, $166 for gas and oil, $21 for supplies, $220 auto expense, and $174 miscellaneous. The department collected 5,773 loads of garbage and 10,352 loads of rubbish and ashes (reported as 8,660 tons and 18,116 tons respectively), and 3,202 dead animals (dogs, cats, horses, skunk, etc.); attended to 38 justified service complaints and 147 unjustified ones, and 418 disposal complaints, and made about 800 inspections and calls. Commercial waste is not collected.

The dumping grounds are centrally located and donated, but on the other hand the area covered is very large and population scattered. The citizens co-operate well, being careful about separating garbage and rubbish and using the proper kind of covered containers.

The total department expense averaged $1.885 per ton of garbage, rubbish and ashes (it was $1.933 in 1930) or 63 cents per capita.

Water Consumption Data

Consumption figures sometimes need explaining, as why Santa Barbara had its maximum 1931 consumption in March. It seems that in the winter months of 1930-'31 and the spring months following, there was very little rainfall to replenish the city water supply. In March the people began their spring gardens but the city asked for a curtailment on the use of water and to secure it raised the rates, so that the use of water decreased rather than increased during the following months.

The maximum hourly consumption of water in Rockford, Ill., is about 10 gallons per person between 5:30 and 6:30 p. m. and is about 166% of the maximum daily consumption, about 240% of the maximum monthly consumption, and slightly over 300% of the average yearly consumption.

In Marshall, Mo., the maximum pumpage in any one day of 1931 was 666,000 gallons on June 19th, and the minimum was 214,000 gallons on November 8th. The average daily pumpage for the year was 391,537 gallons. The unaccounted for water averaged 61,800 gallons a day. Of the total amount pumped, 78.6% was sold through meters, 3.8% was used in flush tanks, washing streets and other municipal uses; 1.7% for the quarterly flushing of fire hydrants, and 15.9% was unaccounted for. The pumpage was measured by meter at the pumping station.

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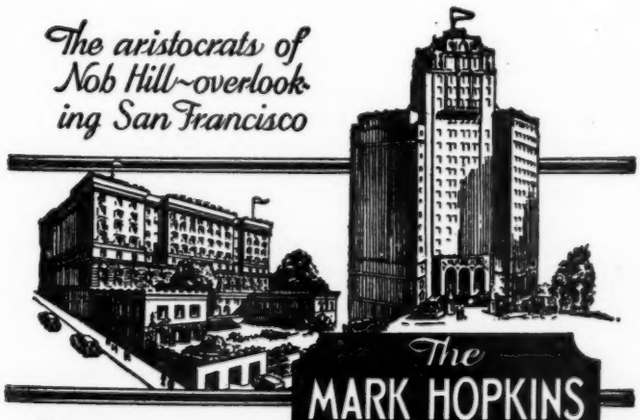

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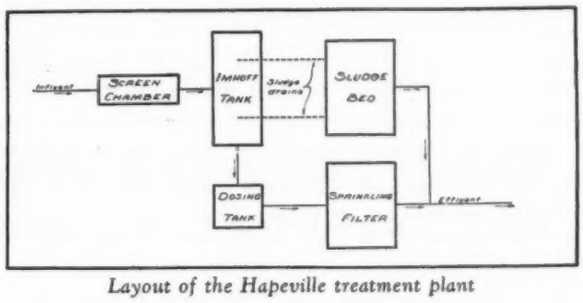
Financing Sewage Treatment at Hapeville, Georgia

By R. G. Hicklin, Manager,
Municipal Engineering Dept., Robert and Company, Atlanta

Prior to 1931, the city of Hapeville (population 4324) a borough of Atlanta, Georgia, discharged its sewage untreated into nearby streams, depending upon dilution for sufficient treatment. As the city grew and new residential sections developed, the need for suitable sewage disposal was



Layout of the Hapeville treatment plant

realized and engineers were engaged to work with the city officials and devise plans for correcting this condition.

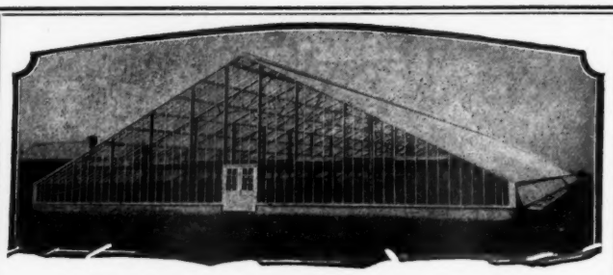
The natural drainage of the city is into four drainage basins, and it was decided, as most economical, to build four small disposal plants rather than install costly mechanical equipment to concentrate all sewage into one plant. The plans for two of these plants have been completed and Plant No. 1 (70,000 g. p. d.) was built in 1931. It is expected that Plant No. 2 (134,000 g. p. d.) will be built this year, and the remaining two plants to be built during the two following years. A four year building program such as this is an ideal system for the small city and can be undertaken without overtaxing the city's financial resources.

The Hapeville plants will all be, basically, of the same design; consisting of coarse bar screens, Imhoff tank, sludge drying bed, dosing tank, and sprinkling filters, as shown on the diagram. No. 1 Plant, which was placed in operation in September, 1931, is designed to serve 700 people.

The large solids, rags, etc, which are retained on the screen are removed daily by hand and placed on the sludge drying bed.

The gas generated in the Imhoff tanks is permitted to escape as the quantity produced in a plant of this size is not sufficient to make collection worth while. The effluent from the Imhoff tank passes over a weir into the dosing tank, which controls the discharge onto the filter. A counter, operated by the rise and fall of the level of the sewage in the dosing tank, records the number of times the tank empties, and is used for calculating the quantity of sewage reaching the filter. The sewage is discharged under a 6-foot head. The effluent from the filter is discharged into a branch, the flow of which is estimated at 140,000 g. p. d.

The sludge deposited in the Imhoff tank is periodically drawn off hydraulically thru two 8-inch sludge pipes and deposited on the sludge drying bed, which consists of four layers of sand and graded gravel. The sludge, when thoroughly dried on the bed, is hauled away and used as fertilizer.



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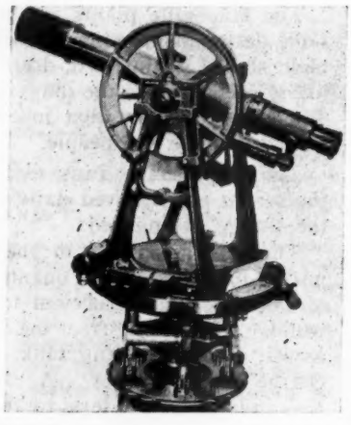

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The cost of operation of a plant of this type is very little. Some one should visit the plant once a day to clear the bar screen, clean down the gas vents and side walls, and examine the spray nozzles. This requires about thirty minutes each day and is the only attention the plant requires, except when it is necessary to draw the sludge. No special technical man is required for this job as the entire operation of the plant may be handled by some member of the street or water department.

The plant constructed in 1931, if let by contract, would have cost about $7,500, or about $11 per person tributary to it. However, the county assisted the city in the work by furnishing the rock for the filter as well as some prison labor, and the actual cost to the city was $7,628 for both the plant and about one mile of 12-inch sewer line.

Garbage Fed Hogs and Trichinosis

A number of cases of trichinosis have been reported in California recently. One large group of cases occurred last spring as a result of the consumption of raw sausage manufactured in the home from a hog slaughtered in the immediate vicinity of a municipal garbage dump. In commenting on the situation, the California Department of Public Health states that strict supervision should be maintained over all places where garbage may be fed to hogs. It is important that no garbage dumps be tolerated in the immediate vicinity of hog ranches. Rat control work should be carried on incessantly at all garbage dumps and no rat harbors of any sort should be tolerated on or near such places. Feeding platforms for hogs, particularly where garbage is fed, should be elevated at least 18 inches above the surface of the ground. Feeding platforms, if upon ground level, should be constructed of concrete and surrounded by a wall of the same material which extends at least 18 inches below ground level and at least four inches above the surface of the feeding platform. All offal from slaughterhouses should be thoroughly cooked before feeding and a suggestion is made that it may be necessary, eventually, to require cooking of all garbage that may be used for feeding hogs, as uncooked offal and scraps of raw pork generally may be found in garbage. The potential source of infection in such products, under present conditions, is considerable and it is quite probable that this disease can not be brought under the control which it deserves without the establishment of regulations which would require the thorough cooking of such garbage.

Examinations conducted recently by the Department indicate that there is a much higher infestation in garbage-fed hogs than in those which are fed with grain. To be sure, grain-fed hogs may become infested as well as garbage-fed hogs, but rats are much more prevalent wherever garbage is found and the probability of infestation is increased greatly wherever these rodents exist. It is important, also, that hog raisers be required to make immediate disposal of all their stock which may die. Too often live hogs are permitted to feed upon dead hogs and strict supervision of hog ranches is necessary as a measure in the control of trichinosis. Until such time as measures such as these are actively enforced, the liability for increased incidence of the disease may be increased greatly.

A Neglected Sewer System Revamped as Unemployment Relief

THE superintendent of public works of Lancaster, N. Y., a village of about seven thousand population, Harold J. Huber, described before the New York State Sewage Works Association the condition which had been caused by years of neglect of the sewers and treatment plant of that village and the means being taken to remedy them.

Previous to 1928 there was never any direct supervision over the sewerage system or treatment plant, and the caretaker had kept no records of its operation. In 1928 a department of public works was established and ordered an immediate investigation of it, which was hastened by a flood which completely buried it with mud. The treatment plant, which had been built in 1908, consisted of two very deep grit chambers, wire screens, two covered septic tanks operating in parallel and four contact beds on to which the tank effluent was to be distributed by Miller-Potter syphon apparatus. The effluent was discharged into Cayuga creek through an outfall sewer provided at the outlet with a swinging flood gate, as a rise of two feet in the creek caused it to back up into the plant. Pumps had been provided for lifting the sewage on to the contact beds, but their capacity was only about a twenty-fifth of the sewage flow during storms, and the sewage filled and overflowed the plant at such times.

The grit chambers, which were 9.75 ft. deep, acted as septic tanks, and scum formed on them which blocked the screens and gave off very offensive odors. The septic tanks were filled with sludge to the flow line, and the crude sewage was flowing in channels across the top of this sludge and being delivered in this state on to the contact beds. Incidentally, due to faulty outlet construction, the operating depth of the tanks was only 6 ft., although intended to be 9 ft.

The masonry between the air-lock chambers of the dosing apparatus was in very bad condition and leakage between chambers made proper functioning of the apparatus impossible. The only outlet from the bottom of the contact beds was through one 15-inch half tile and two short branches. The pumps had been badly damaged by freezing.

On removing the stone from the contact beds (the stones in the lower half of which were found to be entirely too small for proper service in a contact bed) it was found that even the one 15" drain was unnecessary, for the walls contained numerous holes left by the rotting away of wooden form spreaders which the contractor had not removed when he poured the concrete, and the floor had settled below the side walls about ¾" and contained numerous settlement cracks.

The sewer system was found to be in an equally interesting condition. In undeveloped streets many of the Y's were without covers, or the covers were not tight and water and sand entered. Practically all of the pipe joints were without any caulking whatever, and the exceptions had caulking at the top only. Along a state highway connections had been carried from each Y to beyond the pavement to avoid future cutting of the pavement, and during rains water from the ditches along the side of the road ran through sink holes into all of them. Also a concrete culvert under the road received water at one end but delivered none at the other—the broken floor allowed it all to enter the sanitary sewer beneath.

In several streets the sewer trenches had settled and the surface above served as surface drains, carrying rain water to the manholes, which it entered where frost or man had removed several bricks.

Clogged sewers were numerous. A 15-inch trunk sewer was so clogged with roots that a 1½ inch wooden rod could hardly be pushed through it. Others were nearly full of gravel or other obstructions. In undeveloped land crossed by brooks and drainage ditches wash-outs and cave-ins were numerous. Several of the manholes had been connected to small creeks by tile pipe entering the manhole 4 to 24 inches above the normal flow line, presumably to prevent obstructions in the sewer from backing sewage into house connections; but they carried more water into the sewer than out of it. At practically every drop manhole the upper sewer had settled 3 to 5 inches because the backfilling where the drop connection had been set had not been properly tamped. Several small streams flowing near sewers in undeveloped land changed their courses from time to time during floods and in some cases followed the sewer trenches and contributed their water to the sewage flow through the open sewer joints.

The department of public works has rebuilt the treatment plant, using unskilled labor for unemployment relief, new men coming on each week. The grit chambers were filled with stone from the contact beds to reduce their depth from 9.75 feet to 1.50 feet. Coarse bar screens were installed between them and the septic tanks. The outlets of the tanks were adjusted to raise the water level from 6 ft. to 9 ft. above the floor. The two centrifugal pumps were rebuilt and a third having three times their combined capacity was added to raise the sewage into the creek when this rises about the outlet, which then is closed with a 30" Calco slide gate. This new pump is operated by a 25 h. p. gasoline engine; and both are mounted on a truck and can be hauled into the town for pumping out manholes, etc. This pump is also connected up for pumping sludge from the tanks to sludge beds, two of which, each 30 x 130, were built. A chlorinator and chlorine mixing chamber provide for treating the effluent with up to 100 pounds a day. The four contact beds were repaired and filled with new stone on an adequate underdrainage system. The total cost of this reconstruction was about $15,000.

No money was obtainable for repairing the sewers until $10,000 was obtained from the state's temporary emergency relief administration with the backing of the state health department, to be used in unemployment relief. With this sum about 150 men were kept at work for 61 days, and 4.2 miles of sewer were cleaned and flushed and repaired, and brooks which were flowing over the sewer were returned to their old channels, which were cleaned out, straightened and widened. The sewage flow has been reduced 50 percent. There remains, in addition to cleaning and repairing 29 miles of sewer, the locating and disconnecting of many connections which illegally carry roof water to the sanitary sewers.

Construction News

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Bids Wanted
Streets and Roads

Fla., Tallahassee— July 12
Surfac. treat. 40.480 mi. rds. Madison, Putnam, Hendry, Cos.; plain cem. conc. pav. 1.050 mi. Alachua and Leon Cos., furn. 264,000 gals. liquid asph. for mixed in pl. and asph. surfac. Rd. 83, Okeechobee Co. —State Rd. Dept., H. H. Wells, Chmn.

Ind., Indianapolis— 10 a. m., July 12
Constr. 63.292 mi. var. co. rd. projs.—Indiana State Hwy. Comn., Div. of Constr. J. J. Brown, Dir., State House Annex, 102 N. Senate Ave.

Ia., Indianola— 10 a. m., July 13
Grad. 12.36 mi. co. trunk rds.. 1.23 mi. local co. rds., Warren Co.—Co. Auditor, Court House.

Ia., Knoxville— 2 p. m., July 12
Gravel. surfac. 26,000 cu. yds. and 270,000 units of addnl. half mile haul., Marion Co.—Co. Auditor, Court House.

Ia., Rock Rapids— 2 p. m., July 12
Regravel. rds. consist. 25,000 cu. yds. gravel and 247,000 units of addnl. half mile haul, Lyon Co.—Co. Auditor, Court House.

Kans., Cimarron— 9 a. m., July 20
Shlder. or surfac. rd. oil. 116.600 mi., and 30.141 mi. bit. mat. surfac. var. cos., Div. No. 6.—Div. Engr., Bureau Co. Rds., Court House.

Kans., Hill City— 9 a. m., July 19
Bit. mat. surfac. 33.415 mi. var. co. rds.; sand gravel or limestone gr. 64.400 mi., sand regravel. 84.050 mi., shldr. or surfac. rd. oiling 115.500 mi. var. co. rds. Div. No. 3.—Div. Engr., Bureau Co. Rds., Court House.

Kans., Wellington— 9 a. m., July 22
Bit. matl. surfac. 63.100 mi.; sand gravel. 83.334 mi., shldr. or surfac. road oiling 64.800 mi. var. co. rds. Div. No. 5.—Div. Engr., Fifth Div., Bureau Co. Rds., Court House.

Ky., Frankfort— 10 a. m., July 13
Grad. and drain. surfac. type const. 43.10 mi. 9 county rds.—State Hwy. Comn.

Ky., Frankfort— 10 a. m., July 27
Grad. and drain. type constr. 70.00 mi. 9 county rds.—Ky. State Hwy. Dept., Div. of Constr., Frankfort.

La., Baton Rouge— July 19
26,000 sq. yd. asphaltic cloth surfac. University Ave. and Vanderbilt Dr. from Highland Rd. to Perkins Rd.—East Baton Rouge Parish Police jury.

Md., Baltimore— July 12
Mac. resurfac. 4.48 mi. Cont. D-89-12, Dorchester Co.; conc. shldrs. 6.93 mi. Cont. F-191-511, Frederick Co.—State Roads Comn., G. Clinton Uhl, Chmn., Federal Reserve Bank Bldg.

Md., Baltimore— July 13
Cem. conc. pav. 9,750 sq. yds. Pav. Contr. No. 628.—Dept. of Pub. Wks., Bureau of Hwys., Municipal Bldg.

Mass., Boston— 12 M., July 12
Rein. cem. conc. bit. mac. and bit. conc. 16,994 ft., incl. exten. to conc. arch over Charles River in Wellesley and Newton and over E. branch of Charles River in Newton.—Commonwealth of Mass., Dept. of Pub. Wks., State House, A. W. Dean, Chf. Engr.

Mass., Boston— 12 M., July 12
Blt. conc. pav. 34,100 ft. Bourne and Falmouth; 2,943 ft. rein. conc. and 1,085 ft. rein. conc. and bit. conc. in Arlington; 3,391 ft. bit. mac. in Dighton and Taunton; incl. rein. conc. br. over 3 Mile River and reinf. cart pass in Dighton; 24,978 ft. reinf. conc. in Lenox and Pittsfield.—Dept. of Pub. Wks., A. W. Dean, Chf. Engr., State House, Boston.

Mich., Cadillac— 10 a. m., July 19
Conc. pav. 6.581 mi. U. S. 31, Benzonia to Honor, Benzie Co.—A. L. Burridge, Div. Engr., Cadillac.

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information regarding it as soon as possible, also corrections of any errors discovered.

Mich., Escanaba— 10 a. m., July 26
Conc. pav. 5.268 mi. Delta Co. and 2.444 mi. Menominee Co.—Div. Engr., J. T. Sharpensteen, Escanaba.

Mich., Grand Rapids— 10 a. m., July 13
Grad. and drain. structs. 0.817 mi. on U. S. 131, Proj. M041-51, Contr. No. 1, Kent Co.—State Hwy. Dept., 213 Watson Bldg., Grand Rapids, W. J. Kingscott, Div. Engr.

Mich., Plymouth— 10 a. m., July 21
Conc. pav. 1.408 mi. on U. S. 10, Oakland Co.—Div. Engr., H. G. Oakes, Plymouth.

Mich., Port Huron— 10 a. m., July 20
Cr. limestone surfac. 4 mi. on M-154, Proj. M 077-34, C-3, St. Clair Co.; conc. pav. 3.565 mi. M-15, Proj. F 079-39 C-1, F. A. 259-C, Tuscola Co.—Resident Office State Hwy. Dept., 205 Mercer Bldg., H. W. Hagaman, Div. Engr.

Minn., Ada— 10 a. m., July 20
Gravel. abt. 39 mi. S. A. Rd. and C. A. Rds., Norman Co.—A. Elleraas, Co. Aud., Court House.

Minn., Bemidji— July 12
Constr. Lake Julia Rd., Redby-Grygla Rd. and 2 mi. from Debs N.—A. D. Johnson, Aud., Beltrami Co. Court House. (W. H. Johnson, Co. Hwy. Engr.)

Minn., Benson— 10 a. m., July 12
Gravel. 42.9 mi. Swift Co. on var. rds.—Leo E. Engleson, Aud., Swift Co. Court House.

Minn., Fergus Falls— 2 p. m., July 12
Gravel. 8 mi. S. A. Rd. No. 1, Job 31:07, Richville; C. A. R. No. 30, Richville, Job 30:32.—William Lincoln, Co. Aud., Otter Tail Co. Court House.

Minn., Gaylord— 1 p. m., July 20
Grad. 3.50 mi. and gravel. 22.50 mi. var. co. aid rds., Sibley Co.—Fred. Hoppenstedt, Co. Aud., Court House.

Minn., Hastings— July 12
Gravel. on S. A. R. No. 23; grad. 6 in. conc. pav. and spillway on port. of Town Rd. in Ravenna Twp.; J. M. Langenfeld, Co. Aud., Co. Bd. of Dakota Co., Court House.

Minn., New Ulm— 2 p. m., July 12
Grad. and plac. culvts. on 12.47 mi. Job 32:01, No. 4, No. 5 and No. 6, Brown Co.—L. G. Vogel, Co. Aud., Court House.

Minn., St. Cloud— 2 p. m., July 13
Furn. and apply 70,000 gals. asphaltic bitum. oils or rd. oils along 6th Ave., 8th St., S. A. Rd. No. 21, etc., Stearns Co.—Nicholas Thomev, Co. Aud., Court House.

Minn., St. Paul— 10 a. m., July 19
Plant mix bituminous pav. 47.5 mi., grad. 15.5 mi. shldr. 142.90 mi. var. state projs.; gravel. 173.00 mi. S. Projs.—C. M. Babcock, Comr. of Hwys., State Hwy. Dept., 1246 University Ave., St. Paul.

Neb., West Point— July 14
Grad., relay. brk. and conc. pav. 17,081 sq. yd.; est. cost $50,000.—City Clk., City Hall. (Nixon & Reynolds, Engrs., 309 Omaha Grain Exch. Bldg., Omaha.)

N. Y., Boro. Bronx— 11 a. m., July 14
Sh. asph. on conc. found. repav. lay. sidewalks, setting curb., grad., etc. on var. sts. and aves. in Boro. of Bronx.—Henry Bruckner, Pres., Municipal Bldg., Crotona Park, Tremont and 3rd Aves.

N. Y., Boro. Manhattan—11 a. m., July 12
Regulat., grafite blk. repav. Monroe St., Mercer St., and sheet asph. on new 9 in. conc. found pav. rdway. of Park St., and Baxter St.—Samuel Levy, Pres., Room 2034, Municipal Bldg., New York City.

N. Y., Boro. Richmond— 12 M., July 13
Grad., regulat. blt. conc. repav. Nelson Ave., Richmond Rd., Adam James St., etc. —John A. Lynch, Pres., Boro. Hall, St. George, Staten Island.

O., Cincinnati— 12 M., July 12
Pav., etc., Funlap St. from McMicken to Findlay.—C. A. Dykstra, City Mgr., City Hall.

O., Cincinnati— 12 M., July 12
Pav. and sews. Logan St.—C. A. Dykstra, City Mgr.

O., Cleveland— 12 M., July 12
Resurfac. First and Second Sts.—Vill. of Dover, E. E. Campbell, Clk., R. F. D., Bay Village.

O., Mt. Vernon— July 13
Surfac. treat. 0.378 mi. T-17 Bangs-Johnstown Rd., C. H. No. 19; 5.37 mi. Howard-Danville Rd., 0.956 mi. T-17, Mt. Vernon-Grenville Rd. C. H. No. 13.—Co. Comrs., H. N. Mendenhall, Clk.

O., Newark— 12 M., July 15
Pav. South Buena Vista St.—Guy W. Lawyer, Ser. Dir. (Chas. Wells, City Engr.)

O., Norwalk— 2 P. M., July 15
Pav. Huron-Seneca Co. Line Rd. No. 10, Sec. A and B, Norwich Twp., Huron Co. and Reed Twp., Seneca Co.—Co. Comrs., A. S. Vail, Secy. (C. T. Williams, Co. Engr., Norwalk.)

O., Waynesville— 12 M., July 15
Surfac. treat. rd.—R. F. Hatfield, Clk., Village Hall.

Okla., Oklahoma City— July 12
Grad., drain. 11 mi. U. S. Hwy. 270; 11.1 mi. U. S. Hwy. No. 270, Beaver Co.; est. cost $65,000.—State Hwy. Dept., C. L. Wilson, State Hwy. Engr., Oklahoma City

Pa., Harrisburg— 10 a. m., July 22
Var. types of pav. 13 counties.—Dept. of Hwys., S. S. Lewis, Secy. of Hwys., Room 506, North Office Bldg., State Capitol.

Pa., Spartansburg— 5 p. m., July 13
Resurfac. rd.—J. S. Rifenbrick, Clk., Boro. Hall.

Va., Richmond— July 12
Gravel., mac. pav. and soil. 13.649 mi. projs. Craig, Augusta, Culpeper, Hanover, Charles City, and Prince George Cos.—Dept. Hwys., Richmond.

Wis., Green Bay— 10 a. m., July 13
Conc. surfac. 13.092 mi. Wausau-Shawano Rd., S. T. H. 29, Shawano Co.—Wis. Hwy. Comn., Fred. Sieber, Co. Hwy. Commr.

Wis., Madison— 10 a. m., July 12
Approaches only Silver Lake Grade separation, Kenosha Co. (note change in date).—Wis. Hwy. Commn., Madison.

Wis., Waukesha— 1:30 p. m., July 15
Pav. Baxter St.—A. R. Schuh, Engr.

Sewerage and Sanitation

Ky., Bowling Green— 1 p. m., July 14
Constr. sani. sew. sys.—J. Q. Kirby, City Clk. (J. N. Chester Engrs., 813 Clark Bldg., Pittsburgh, Pa.)

Md., Hagerstown— 1 p. m., July 15
Constr. sewage treatmt. wks. (Adds.)—Ruben Musey, Mayor. (Fuller & McClintock, Engrs., 170 Broadway, New York City, N. Y.) (Note change in date.)

Mo., St. Louis— July 19
Constr. 7,910 ft. 8 to 36 in. vitr. clay brk. set. in port. cement mortar and segmental blk. sews. for Maline Creek Dist. Sew. No. 2; est. cost $28,360.—Bd. Pub. Serv., City Hall, W. W. Horner, City Engr.

N. Y., Boro. Bronx— 11 a. m., July 14
Constr. sews. and appurts. in var. sts. and aves. in Bronx.—Henry Bruckner, Pres., Municipal Bldg., Crotona Pk., Tremont and 3rd Aves.

N. Y., Cooperstown— 5 p. m., July 18
Constr. Sewage Treatmt. Plant.—Alton G. Dunn, Vill. Clk., Vill. Hall.

N. Y., Wingdale— 2 p. m., July 27
Constr. sewage disposal sys. at Harlen

Valley State Hospital, Dutchess Co.; est. cost $292,269.—Dept. of Mental Hygiene, F. W. Parsons, Comr., State Office Bldg., Albany.

O., Cleveland— July 15
Improv. sewage disposal plant, Rocky River Valley below end of W. Clifton St., Lakewood.—Amos I. Kaufman, Mayor. (E. A. Fisher, City Engr.)

O., Columbus— 12 M., July 12
Constr. of sewerage and sewage disposal contr. No. 14, Contr. No. 7, Alum Creek Storm Standby tank.—W. P. Halenkamp, Dir. of Pub. Service, City Hall.

Pa., Harrisburg— 11 a. m., July 14
Constr. 496 ft. rein. conc. sew. and 55 ft. cement conc. pipe sew. from 20th and Boas St. thru private property, etc.—Dept. of Sts. and Pub. Improvmts., Bureau of Hwys., H. A. Sherk, Dir., Room 403, City Hall.

Pa., McKeesport— 2 p. m., July 21
Constr. sani. sews. incl. 10 in. terra cotta in Nessly St., and 8 in. in Golden Alley.—City Clk., City Hall.

Pa., Pittsburgh— 8 p. m., July 15
Constr. 30 in. terra cotta pipe or conc. sew. in Girty's Run; est. cost $200,000.—Secys. Twp. Committees, Samuel Hamilton School, Perry Hwy. and Cemetery Lane, Ross Twp. Hall.

Wis., Kohler— 4 p. m., July 18
Constr. sewage disposal plant and garbage incinerator. — William Nesemann, Clk. (Jerry Donohue Engrg. Co., Engrs., Sheboygan, Wis.)

Wis., Portage— 10 a. m., July 19
Constr. sewage treatmt. plant, incl. imhoff settling tank trickling filters, pump. sta., etc.; est. cost $60,000.—Mrs. Francis Wright, Clk. (Pearse, Greeley and Hansen, Consl. Engrs., 6 No. Mich. Ave., Chicago, Ill.)

Water Supply

Ia., Dubuque— 10 a. m., July 12
Lay. water and gas connects. in Kleine St.—J. J. Shea, Clk., City Hall.

Neb., Valley— 4 p. m., July 14
Constr. waterworks improvmts. Sec. 1, 2, 3, 4 and 5, includ. pump, well, pipe and pump house, etc.—Lawrence Coy, Vill. Clk., Village Hall. (Henningson Engrg. Co., Engrs., 326-30 Union State Bank Bldg., Omaha.)

Pa., Erie— 10:30 a. m., July 15
Erect. of standpipe with found.—Commrs. of Water Works, J. S. Dunwoody, Supt., 701 French St., Erie.

Va., Norfolk— 2 p. m., July 15
Constr. and delivering 2 triple expansion pump engines.—U. S. Engr. Office.

Wis., Waukesha— 2 p. m., July 12
Gen. const. of pump house and reservoir; est. cost $15,000.—Bd. Water Commrs., 132 No. St., H. E. Blair, Pres.

Bridges

Fla., Tallahassee— July 12
Constr. 121 ft. br. Gadsden Co.; 101 ft. br. deck girder spans Hardee Co., 1,890 lin. ft. 18 in. and 1,160 lin. ft. 24 in. corrug. metal pipe, Seminole Co.—State Road Dept., H. H. Wells, Chmn., Tallahassee.

Ill., Marseilles— 10 a. m., July 12
Constr. superstruct. of Br. over Illinois River. Contr. B-20.—Dept. Purchases and Const., Div. of Waterways, Springfield.

Ky., Frankfort— 10 a. m., July 27
Constr. br. overflow struct on So. Carrollton-Island Rd.; fourteen 30 ft. deck girder spans on conc. pile trestle bents, Muhlenberg Co.—State Hwy. Dept., Div. of Constr.

Mass., Boston— 12 M., July 12
Constr. reinf. conc. br. over Quinobequin and Chestnut St., steel arch over Centre St. and steel stringer br. under Parker St. in Wellesley and Newton.—Dept. of Pub. Wks., A. W. Dean, Chf. Engr., State House.

Minn., St. Paul— 10 a. m., July 19
Constr. Bridges on var. State Projs., and port. and mono. conc. culvts.—C. M. Babcock, Comr. of Hwys., State Dept. Hwys., 1246 University Ave.

Mo., St. Louis— July 26
Constr. founds. rein. conc. piers, abutmts. approaches fill for So Valley approach to R. R. deck St. Louis Municipal Bridge, over Mississippi River; est. cost $58,000.—Bd. Pub. Service, City Hall. (C. E. Smith & Co., Consult. Engr., 1752 Railway Exch. Bldg.)

Neb., Lincoln— 9 a. m., July 21
Constr. conc. box culvt., and 15 bridges, Lodi-Eddyville Projs. 627-G and H, State Rd.—Dept. of Pub. Wks., R. L. Cochran, State Engr., State House.

N. J., Trenton— 11 a. m., July 18
Constr. br. across Shark River on Rte. No. 4 (1917) bet. "F" St., Belmar and Main St., Avon, Monmouth Co.—State Hwy. Comn., State House Annex, A. Lee Grover, Chief Clk.

O., Bucyrus— 10 a. m., July 16
Constr. steel br. No. 2, Rd. No. 117, Bucyrus Twp. and conc. twin slab br. No. 23, Rd. 19, Dallas Twp.—Co. Comrs., C. I. McNeal, Co. Engr.

O., Dayton— 10 a. m., July 16
Constr. low steel truss super-struct. br. No. 175, German Twp. Mud Lick Rd., Montgomery Co.—Co. Comrs., F. A. Kilmer, Clk., Court House.

Okla., May— July 12
Constr. 19 span 370 ft. rein. conc. trestle, Beaver Co.; est. cost $30,000.—State Hwy. Dept., C. L. Wilson, State Hwy. Engr., Oklahoma City.

Pa., Harrisburg— 10 a. m., July 22
Const. bridges in var. cos.—Dept. of Hwys., S. S. Lewis, Secy., Room 506, North Office Bldg., State Capitol.

Wis., La Crosse— 10 a. m., July 14
Const. Hanson Br., Moes Br., and Kamla Br., Trempealeau Co.—Wis. Hwy. Comn., T. M. Reynolds, State Div. Engr.

Wis., Madison— 10 a. m., July 12
Constr. Lone Rock Br. and approaches bet. Richland and Sauk Cos. (Note change in date.)—Wis. Hwy. Comn., Madison. (C. H. Kirch, State Br. Engr.)

Drainage and Irrigation

Del., Wilmington— 2 p. m., July 26
Furn. all labor and matl. and perform. wk. for dredg. 225,000 cu. yds. matl. in Inland Waterway from Delaware River to Chesapeake Bay, Del. and Md. (Chesapeake and Delaware Canal.)—U. S. Engr., Office.

Mich., Port Huron— July 15
Dredg. 1,767,000 cu. yds. in channel, at Foot Lake Huron, nr. here.—U. S. Engineer's Office, Detroit, Mich.

O., Lewisburg— July 23
Clean and repair. Stingle Ditch.—Co. Comrs., Ivan Earhart, Co. Engr., Eaton, O.

R. I., Providence— 2 p. m., July 22
Dredg. Pawtucket River.—U. S. Engr.

R. I., Providence— 2 p. m., July 22
For dredg. 40,000 cu. yds. in Housatonic River, Conn.—U. S. Engr. Office, Providence.

S. C., Charleston 12 M., July 27
Furn. labor and matl. and dredg. 308,503 cu. yds. in Waterway from Charleston to Winyah Bay, S. C.—War Dept., U. S. Engr. Office.

Va., Norfolk— 3 p. m., July 15
Dredg. 1,120,000 cu. yds. matl. in Dismal Swamp Canal, Va., and N. C.—U. S. Engr. Office, Norfolk, Va.

Miscellaneous

Fla., Jacksonville— 12 M., July 19
Constr. 65,000 lin. ft. levee and navigation channel along so. and e. shore of Lake Okeechobee, involv., plac. 4,860,000 cu. yds. matl. in levee, and 55,000 cu. yds. riprap along the berm.—War Dept., U. S. Engr. Office, P. O. Box 45.

Mo., St. Louis— Aug. 4
Constr. 7,000 ft. revetment of Front Levee along Mississippi River.—East Side Levee and Sani. Dist.

Tenn., Memphis— 2 p. m., July 15
Constr. 166,700 cu. yds. earthwk. on Bird's Point-New Madrid Floodway Levee.—U. S. Engrs. Office, P. O. Box 97.

W. Va., Huntington— 10 a. m., July 30
Constr. roller dam and permanent lock gate at Marmet, W. Va., on Great Kanawha River, abt. 9 mi. above Charleston, W. Va.—U. S. Engr. Office.

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Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m. advanced standard time which is twelve o'clock noon eastern standard time, on Tuesday, July 12th, 1932, for the construction of highways in the following counties:

	Deposit Required
BROOME (Cons. & Recon.)	$10,000.00
(Prel. Gravel Surfacing: 6.13 miles)	
CHAUTAUQUA (Bit. Mac. Mixing Method Type 3 :3.61 miles)	7,000.00
HAMILTON & WARREN (Prel. Gravel Surfacing: 14.88 miles)	30,000.00
QUEENS (Furnishing Top Soil)	250.00
NASSAU & QUEENS (Sheet Type Concrete: 0.16 miles)	1,500.00
ST. LAWRENCE (Prel. Gravel Surfacing: 6.96 miles)	9,000.00

Also for the reconstruction of the following:

GREENE (Bit. Mac. Pen. Method Type 2: 1.04 miles)	3,500.00
ONEIDA (Bridge—47' Rigid Frame Bit. Mac. Mixing Method, Optional Approach: 0.02 miles)	500.00
ROCKLAND (Concrete: 0.74 miles)	4,200.00

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center Streets, New York City. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

A. W. BRANDT,
Commissioner of Highways.

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ALBANY, N. Y.

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Also for the reconstruction of the following:

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ONONDAGA & CORTLAND (Cons. & Recons.) (Bit. Mac. M. M. O. Prel. Gravel Sur.: 6.30 miles)	8,000.00
ESSEX & HAMILTON (Optional Bit. Surf.: 26.49 miles)	14,000.00
MONROE (Concrete: 1.51 miles)	6,000.00
LIVINGSTON & ONTARIO (Cons. & Recons.) (Bit. Mac. M. M. Type 3: 11.77 miles)	25,000.00
ORLEANS (Bridges: Twin 17' slabs, 28' Concrete Beam; 100' Truss with Two 40' Girder—Concrete & Grading Appr.: 0.96 miles)	6,000.00
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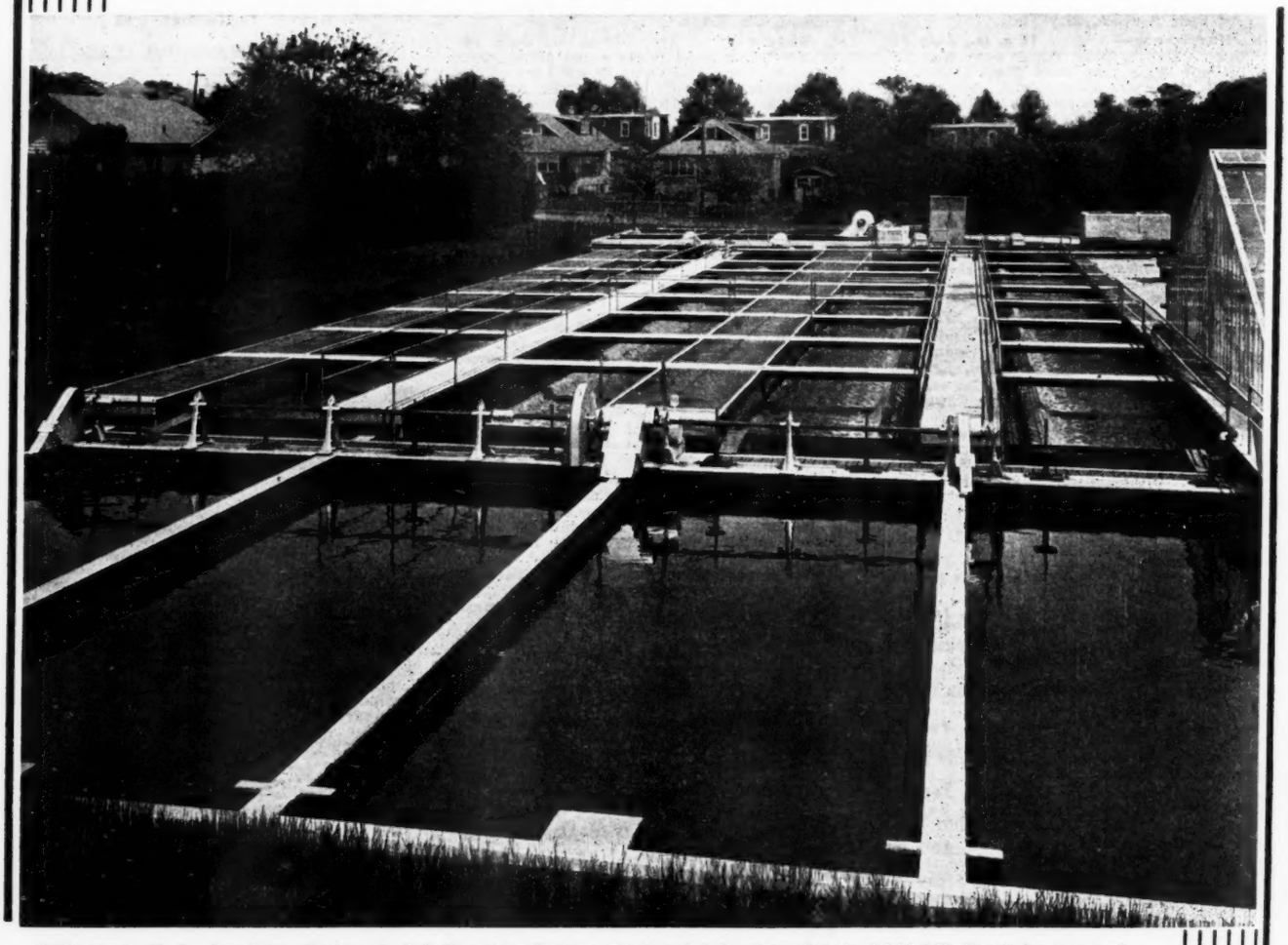

Collingswood, N. J. (Remington, Vosbury & Goff, Consulting Engineers) activated sludge plant. Capacity 1.3 M.G.D. Population connected 13,500. Two primary settling tanks with Link-Belt Straightline collectors in background. Aeration tanks with Link-Belt Straightline aerators in center and four final settling tanks with Link-Belt Straightline collectors in foreground. The clearness of the effluent is indicated by the reflections in the tanks.

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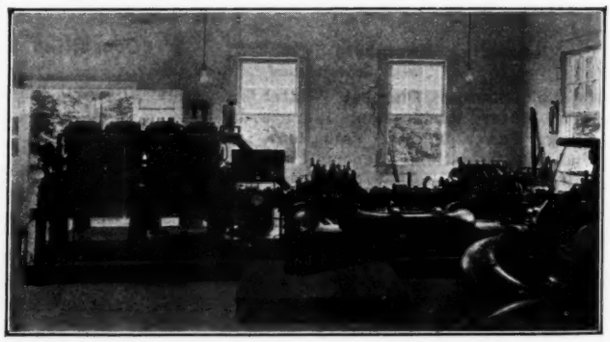

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The Water Wheel

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The Canadian Engineer, Vol. 62, No. 19 (May 10, 1932.)
12. Removal of Tastes and Odors in Water, F. H. Waring, pp. 15-16.
n13. Water Consumption at St. John's, Anon., p. 42.

The Canadian Engineer, Vol. 62, No. 20 (May 17, 1932.)
14. Centrifugal Pump Efficiency Guarantees, R. N. Austin, pp. 8-10.
15. A. W. W. A. Convention at Memphis, Tenn., Anon., pp. 13 and 39.

The Canadian Engineer, Vol. 62, No. 22 (May 31, 1932.)
16. Wolfville Water Distribution System, W. E. Hill, pp. 7-9 and 50-51.
17. Iron Removal Without Filtration, E. T. Archer, pp. 11-12 and 49.

The Canadian Engineer, Vol. 62, No. 23 (June 7, 1932.)
18. Development of Turbine Well Pumps, David J. Conant, pp. 15-16, and 40.
19. Swimming Pool Engineering, J. R. McColl, pp. 17 and 44.
n20. Sterilization of Private Water Supplies, Anon., p. 51.

The Canadian Engineer, Vol. 62, No. 24 (June 14, 1932.)
21. European Hydraulic Structural Design, Eric C. Molke, pp. 5-8.
22. New Toronto Filtration Plant, Anon., pp. 36 and 42.

Chemical News, Vol. 144, No. 3759 (April 29, 1932.)
23. A Theory of the Rate of Solution of Gas Into Liquid, Susumu Miyamoto, pp. 273-279.

Chemical News, Vol. 144, No. 3762 (May 20, 1932.)
24. Monosaccharose Configurations and Interrelations, J. F. Snell, pp. 321-326.

Civil Engineering, Vol. 2, No. 6 (June, 1932.)
25. Protection of Concrete by Glazed Tile, Augustus Griffin, pp. 370-372.
26. When Elevation Does Not Produce River Flow, C. E. Grunsky, pp. 373-374.
27. Combatting Leakage in Concrete Dams (a letter), A. K. Pollock, pp. 377-378.

The Commonwealth (California), Vol. 7, No. 2 (June 2, 1932.)
28. The State Water Plan, Frank Adams, et al, pp. 51-132.

Contract Record and Engineering Review, Vol. 46, No. 21 (May 25, 1932.)
29. Prospects in the Water Works Field: Considerable Construction Projected, Anon., pp. 565-566.

Contract Record and Engineering Review, Vol. 46, No. 22 (June 1, 1932.)
30. High Technical Standard at Memphis Water Works Convention, pp. 640-644.

Contract Record and Engineering Review, Vol 46, No. 23 (June 8, 1932.)
31. High Technical Standard at Memphis Water Works Convention, II, Anon., pp. 667-668.

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n32. The Dowser's Art, Letters by S. P. Christie and Anon., p. 479.

The Engineer, Vol. 153, No. 3982 (May 6, 1932.)
*33. Some Aspects of the Corrosion Problem, I, Ulick Richardson Evans, pp. 504-506.

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n34. Water Divining (a letter), "F. N. B.," pp. 525.
35. Some Aspects of the Corrosion Problem, II, Ulick Richardson Evans, pp. 532-533.

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36. Prettyboy Dam, Baltimore, Anon., pp. 553-554 and 558.
37. Lorry Handling Pipes and Bars, Anon., p. 566.

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38. A Lorry for Carrying Pipes Across the Desert, Anon., p. 594.
39. Foaming of Boiler Water, Anon., p. 595.

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40. Residual Mass Percentage Rainfall Records for the British Isles, Alfred A. Barnes, pp. 510-511.

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41. Predicting the Internal Motion of Sand, C. F. Jenkin, p. 561.

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42. The Deptford Pumping Station of the Metropolitan Water Board (London), Anon., pp. 617-619 and Insert Plate No. 32.
43. Some Aspects of the Corrosion Problem, Ulick Robertson Evans, pp. 639-641.

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44. Constructing the Santiago Creek Rolled Earth Dam, C. R. Browning, pp. 682-683.
45. Loss of Head at Branches Determined for Water Pipes, D. Thoma, Translated by Eugene E. Halmos, p. 684.
46. A. W. W. A. Program Stresses Safety and Economy, Anon., pp. 698-701.
47. Tank Roof Floated into Place, Anon., pp. 702-703.
n48. Detroit Water Board Drops 130 Men from Payroll, Anon., p. 706.

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49. Building a Water Supply Unit from Intake to Filters, Franklin Hudson, pp. 727-729.
50. El Capitan Dam near San Diego, Anon., p. 748.

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51. Steel Plates with Welded Joints Seal Rockfill Dam, H. I. Reid, pp. 761-763.

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52. Developing Good Will for the Water System, Anon., p. 787.

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53. Developing a Water Supply from a Polluted Chinese River, H. Stringer, pp. 833-837.
54. Unknown Drain Causes Leak in Reservoir, Anon., p. 842.
55. Twenty Mile C. I. Water Line for Lincoln, Nebraska, Anon., p. 844.

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56. Pure Cool Water, Sanford DeHart, p. 235.

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57. Untersuchungen über die Entwicklung zentralen Wasserversorgungen in Deutschland seit dem Jahre 1911, Kurt Hühnerberg, pp. 336-339.

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58. Zur Korrosinsfrage, II, Eisen, E. Naumann, pp. 349-351.
59. Schwarzguss Fittings, W. Hartung, pp. 359-362.

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60. Zur Korrosionsfrage, III, Aluminum, Blei, Kupfer, L. W. Haase, pp. 372-374.

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61. Schutz der Wasserläufe gegen die Entwicklung phenolhaltiger Abwässer im Ruhrkohlengebiet, Wiegmann, pp. 433-436.
62. Die machinellen Einrichtung des neuen Düsseldorfer Wasserwerks "am Staad," Remde, pp. 458-462.

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63. Le captage et l'adduction à Paris d'au provenant des alluvions des vals de Loire, Sentenac, pp. 433-438.

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n64. Le baguette des sourciers, Anon., p. 479.

Le Genie Civil, Vol. 100, No. 22 (May 28, 1932.)
65. Les pompes Birotor, Anon., p. 548.
66. La Recherche des Eaux Souterraines, A. Pali, Balliére et fils, Paris, 189 pages, 60 figures. Review of book, p. 556.

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67. Ein einfaches graphisches Verfahren zur Berechnung von Grundwasserersenkunsanlagen, insbesondere solcher mittels gewebeloser Brunnen, Schmach, pp. 208-211.
68. Grenzen der hygienischen Anforderungen in der öffentlichen Gesundheitspflege, O. Spitta, pp. 211-214.

Gesundheits Ingenieur, Vol. 55, No. 19 (May 7, 1932.)
69. Einfachtes Verfahrung zur Berechnung des Abkuhlungs-und Anheizvorganges in einer Platte, W. Matschinsky, pp. 219-222.
70. Ein einfaches graphisches Verfahrung zur Bereshnung von Grundwasserersenkungsanlagen, insbesondere solcher mittels gewebeloser Brunnen, Schmach, Continued pp. 224-226.

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71. Untersuchungen über das Vorkommen von Bahteriophagen in Oberflächenwasser, E. Gildemeister and Hotori Watanabe, p. 241.

Gesundheits Ingenieur, Vol. 55, No. 22 (May 28, 1932.)
72. Die Erneuerung des Wasserwerks der Stadt Lössnitz i. E., Herzner, pp. 257-261.
73. Bestimmung von Salzsäure in der Luft, A. Heller, pp. 261-262.

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n74. Typhoid Fever Occurs in Factory Houses, Anon., p. 94.

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75. Data on Water Temperature for Refrigeration, Anon., pp. 34-35.

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76. Piping a Blow-Down Which Saves $11.64 Daily, Clyde R. Hovey, Jr., pp. 416-418.
77. Loss of Head in Copper Pipe and Fittings, F. E. Giesecke and W. H. Badgett, pp. 443-444.

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78. Efficient Production of Manufactured Ice, Dana Burk, Jr., pp. 605-610.
79. Rate of Absorption of Carbon Dioxide in Water and in Alkaline Media, John W. Payne and Barnett F. Dodge, pp. 630-637.

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80. Acid Treatment of Incrusted Water Wells, Anon., pp. 1-3.

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81. The Use of the Antimony Electrode in Electrometric Determination of Magnesium, B. B. Malvea and James R. Withrow, pp. 2243-2247.
82. The Composition of Magnesium Oxychloride, H. S. Lukens, pp. 2372-2380.

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83. Pressure Losses in Customers' Services, H. W. Niemyer and J. A. Bruhn, pp. 623-624.
*84 Taste and Odor Elimination, John R. Baylis, pp. 635-659.
85. Larval Contamination of a Clear Water Reservoir, Clarence Bahlman, pp. 660-664.
86. Chironomus in a Water Supply, Carl A. Hechmer, pp. 665-668.
87. Trunk Main Surveys, Edgar K. Wilson, pp. 669-676.
88. Installation and Maintenance of Gate Valves, C. E. Angilly, pp. 677-681.
89. Aeration with Compressed Air for Removing Odors, Ross A. Thuma, pp. 682-691.
90. The Stub Plan of Customers' Accounting, M. F. Hoffman, pp. 692-699.
91. A Granulometric Test for Sand, Christien M. Wichers and E. Jacobs, pp. 705-715.
92. New Iron Removal Plant at Warrenton, N. C., M. F. Trice, pp. 716-724.
93. Value of Water Works Conventions to Plant Operators, Jane H. Rider, pp. 725-727.
94. Copper Sulfate as an Algicide, J. K. Marquis, pp. 728-732.
95. Coagulation with Lime and Chlorine, Emil K. Ventre, pp. 733-736.

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96. The Selection of a Dilution Water for Bacteriological Examination, C. T. Butterfield, pp. 355-368.

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97. Intestinal Bilharziasis in St. Kitts, B. W. I., S. B. Jones, pp. 129-136.
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98. The Inspection of Cast Iron Pipe, p. 547.
99. The Winter Use of Swimming Baths, A. E. Reed, p. 562.
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100. Salamanders and Water Hygiene, William G. Hassler, pp. 303-310.
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101. Selecting Size of Raw Water Orifice for a Softener, R. F. Hollis, p. 697.
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102. Types of Gates Used on Dams in Europe, Eric C. Molke, pp. 852-853.
103. Ways to Protect Pumps, Questionnaire Replies, pp. 860-861.
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104. Suction Lift for Pumps, Donald McFee, pp. 876-877.
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105. Increasing the Efficiency of Water Treating Systems, J. A. Holmes, pp. 414-415.
106. Service Water Heater Essentials, W. J. O'Brien, pp. 420-421.
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107. Placing pH in Corrosion and Water Treatment, S. E. Tray, pp. 487-489.
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108. Application of Duration Curves to Hydroelectric Studies, G. M. Hickox and G. O. Wessenauer, pp. 713-727.
109. Standard Symbols and Glossary for Hydraulics and Irrigation, D. C. Henry et al., pp. 729-755.
110. Design of Large Pipe Lines—Discussion, C. P. Vetter; L. E. Grinter; Oren Reed, pp. 765-774.
111. Soil Mechanics Research—Discussion, George Paaswell; John H. Griffith; H. E. Gruner, pp. 775-789.
112. Public Supervision of Dams—Symposium—Discussion, I. C. Steele and Walter Dryer; Fred Noetzli; George N. Carter; George W. Hawley; H. K. Barrows, pp. 839-851.
113. Determination of Principal Stresses in Buttresses and Gravity Dams—Discussion, W. J. Stech; Hakan D. Birke; Dirk A. Dedel; Fred A. Noetzli; Eugene Kalman, pp. 859-879.
114. Water Pressures on Dams During Earthquakes—Discussion, John H. A. Brahtzand; Carl H. Heilbron; Boris A. Bakhmeteff, pp. 897-913.
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115. Influence of Temperature on the Life Processes and Death of Bacteria, Bettylee Hampil, pp. 172-196.
116. The Utilization of Water Colloids and Material in Suspension by Aquatic Animals—with especial reference to Mosquito Larvae, E. Harold Hinman, pp. 210-217.
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117. Better Water Conditions Pay Large Dividends,. Anon., pp. 973-975.
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118. B. & O. is "Sold" on Water Treatment, Anon., pp. 382-386.
119. Method of Loading Wrought Iron Pipes, Anon., pp. 242-243.
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120. The Technique of Bending Wrought Iron Pipe, Anon., pp. 245-248.
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121. The Use of Color Filters in Colorimetric Analysis, R. H. Hamilton, Jr., pp. 653-654.
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n122. We Publish a Correction (about radium waters), Editorial, p 331.
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123. Preparation and Carrying Through of a New Baths Scheme, Charles N. Bond, pp. 475-477.
n124. Removal of Tastes and Odors from Water: Treatment with Activated Carbon, Anon., pp. 484.
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125. Corrosion of Water Mains: Cleaning Methods in Dublin: A "Disappointing" Result, Cost of Work, M. A. Moynihan, p. 494.
126. Economics of Municipal Baths and Wash Houses, H. R. Austin, pp. 496-498.
127. The Winter Use of Swimming Baths, A. E. Read, pp. 501-502.
Surveyor, Vol. 81, No. 2104 (May 20, 1932.)
128. Water Supply: Determination of Future Requirements; The Three Years' Standard, Non-Productive Expenditure, John K. Swales, pp, 517-518.
n129. Coagulation of Water: Filter Plant Operators' Methods: An Appeal for Information, Anon., p. 520.
130. London's Water: Safeguarding Methods: Sir Alexander C. Houston's Annual Report (26th), Anon., p. 523.
131. Pressure Filtration for Towns Water Supply: The Halifax Extensions, Anon., p. 525.
132. Sheffield's Water Works, John K. Swales, p. 525.
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133. Abstract Science and Academic Theory in Relation to Hydraulic Flow in Concrete Pipes and Culverts, Ernest H. Essex, pp. 535-537.
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134. An Improved Indicator Chart, Anon., p. 3.
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135. La Question des eaux potables a La Rochelle, Alimentation de la ville par la prise de Perigny actuellement envahie par l'eau de mer, remise en état, et par les eaux souterraines des vallées de laJarne et Salles sur mer, E. Maynard, pp. 73-80.
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136. The New Water Treatment and Pumping Station at Memphis Uses Cast Iron Pipe, Anon., pp. 24-27 and 35.
137. Remarkable Service of Cast Iron Pipe in San Francisco, R. W. Martindale, pp. 32-33.
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138. West Cheshire Water Company: "Permutit" Water Softening Installation, Anon., pp. 197-199.
139. The "Apparent Length" Method of Determining the Diameters Necessary When Extending Pipes, R. Butler, p. 199.
140. The Geology of the Goyt Valley, with Special Reference to the Stockport Corporation Waterworks, Edgar Norton, pp. 201-206.
141. Artesian Well Borings: Some Recent Developments, Anon., pp. 206-209.
142. Rainfall, IV, Records of Self-Recording Raingauges, Anon., pp. 209-212.
n143. Absorption of Iodine by Activated Carbon, Anon., p. 212.
144. Water Legislation (in Great Britain): Report of Committee of the Association of Municipal Corporations, Anon., pp. 217-219.
145. Centrifugal Pump Testing Plant, II, H. Cardinal von Widdern, pp. 220-222.
146. Current American Water Works Practice: Cast Iron or Steel Pipe: Manganese in Water: Aerial Maps, W. Gordon Carey, pp. 223-224.
147. Corrosion of Iron and Steel: Application of Liquefied Lead, Anon., pp. 224.
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148. Water Supply for the Paper Industry, L. M. Booth, pp. 160-162.
n149. Handling Meter Complaints, E. F. Dugger, p. 162.
150. The 52nd Annual Convention of the A. W. W. A., Anon., pp. 163-167.
151. Water Treatment and Purification Problems Discussed at the Memphis Convention of the AWWA, John R. Baylis, pp. 171-174.
152. Oklahoma Water and Sewage Short Course, H. E. Schlenz, pp. 181-184.
153. What Value Are Water Works Conventions to Operators, Jane H. Rider, pp. 185-186.
n154. How Big Is a Microbe, Editorial, p. 188.
Water Works and Sewerage, Vol. 79, No. 6 (June, 1932.)
155. Aeration, Part 1, The Effect of Films at the Water-Gas Interface, John R. Baylis, pp. 195-198.
156. The 52nd Convention of the AWWA, Contd., Anon., pp. 202-208.
157. Pressure Losses in Customers' Services, H. W. Niemyer and J. A. Bruhn, pp. 208-213.
158. Water Works Intake Clogged by Needle Ice, M. J. Hamason, p. 220.
Water Works Engineering, Vol. 85, No. 10 (May 18, 1932.)
159. A Difficult Pipe Repair, William W. Brush, pp. 634-635 and 662.
160. Diesels for Water Service, Robert E. McDonald, pp. 636-638.
*161. The Water We Drink, II, Caleb Mills Saville, pp. 639-640.
162. Emergency Relief Measures Featured in AWWA Program, Anon., pp. 642-648.
163. Freeing the Superintendent from Political Control, Questionnaire Replies, pp. 652-654.
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164. Ground Water Supply Provides Present and Future Water Needs of Minot, N. D., Howard E. Simpson, pp. 686-689.
165. The Water We Drink, III, Caleb Mills Saville, pp. 690-692.
166. Determining the Type of Casing and Proper Diameter of Wells, A. Blakesly, p. 692.
167. Many Practical Topics with Wide Discussion, Included in AWWA Convention Proceedings, Anon., pp. 693-699.
n168. Caulfield, Former AWWA President, Dead, Anon., p. 699.
169. Purchasing Supplies for the Water Department, Questionnaire Replies, pp. 700 and 703-704.
170. Water Works Improvements Form Important Part of President Hoover's Relief Plan, Editorial, pp. 707-708.
n171. Marco Polo Blamed Water for Goiter, Anon., p. 708.

Life of Water Works Department Trucks

Trucks. The Mobile, Ala., water department owns 15 motor trucks, of which ten are 1-ton and five are 1 to 1½-ton. T. C. White, superintendent, considers the average useful life of these trucks to be about five years.

Replying to an inquiry as to life of water department trucks, V. E. Trace, superintendent of the Santa Barbara, Calif., water department reports that they bought a White truck in 1915 and it still is in daily service.

Gastonia, N. C., water department operates a 1-ton and two 1½-ton motor trucks at an average cost of 3 cts per mile for oil, gas, tires and all other expenses. The average annual mileage has been 6,691. C. E. Rhyne, superintendent, estimates the average useful life at five years.

Technical Societies

Tenth Annual Asphalt Paving Conference

New Orleans has been chosen by The Asphalt Institute for the Tenth Annual Asphalt Paving Conference, to be held this year either in the week of November 28 or December 5.

The program, in recognition of present economic conditions, will be devoted largely to phases of Low-Cost road construction, the major subjects for discussion including:

1. The salvaging of all pavements which are in need of resurfacing or replacement, by utilizing inexpensive types.

2. The serious economic aspects of tax diversion and tax evasion of highway revenues.

3. The urgent necessity of designing roads in proportion to their importance —eliminating the "over-designing" evil.

The Association of Asphalt Paving Technologists will, as usual, meet in conjunction with the paving conference.

Elected officers of The Asphalt Institute for the current year comprise: William H. Kershaw, of The Texas Company, President; C. W. Bayliss of the Barber Asphalt Company, B. L. Boye of the Standard Oil Company of New York and J. A. Blood of the Standard Oil Company of California, Vice-Presidents; J. S. Helm of the Standard Oil Company of New Jersey, Chairman of the Executive Committee; and A. M. Maxwell of the Standard Oil Company of Ohio, Secretary.

Asphalt Institute activities west of the Rocky Mountains are under the special jurisdiction of a managing committee composed of J. A. Blood of the Standard Oil Company of California, Chairman; W. G. Julier of the Gilmore Oil Company, Ltd., E. Whitehead, Associated Oil Co., J. F. McSwain of the Shell Oil Company and Lawrence Wolff of the Union Oil Company of California.

The Imperial Oil, Ltd., which due to economic conditions withdrew last year, has been reelected to membership in the Institute.

New York State Sewage Works Association

By A. S. Bedell
Secretary and Treasurer

The New York State Sewage Works Association held its spring meeting at the Hotel Statler, Buffalo, N. Y., June 10-11, 1932. One hundred and thirty members, guests and wives were registered. The exhibits of twenty-seven manufacturers were displayed.

At the luncheon following registration and inspection of manufacturers' exhibits Friday morning, Hon. W. A. Rathman, Commissioner of Public Works, Buffalo, N. Y., welcomed the association to Buffalo. The afternoon session was devoted to a brief business session and to the presentation of technical papers and discussion. President Earle B. Phelps announced that the third Short School for Sewage Works Operators would be held at Cornell University next year, probably in April. In the absence of Clyde Potts, Chester G. Wigley of Atlantic City read the former's paper on "The Design and Operation of Settling Tanks." Harold J. Huber, Superintendent of Public Works, Lancaster, gave a most interesting paper on "Experiences in Remodeling a Sewage Treatment Works and in the Elimination of Excessive Ground Water Infiltration in a Sanitary Sewer System," and E. B. Besselievre of the Dorr Company presented a paper on "Mechanical Equipment Employed in Recovering Sludge from Settling Tanks." The discussion on the latter was opened by M. B. Tark and M. C. Fleming and a lively discussion followed the presentation of each paper.

The Round Table Discussion Saturday morning covered the following topics: A. F. Dappert, "Travel of Pollution Under Ground;" C. C. Agar, "The Significance of Laboratory Tests at Sewage Treatment Plants"; Earle B. Phelps, "Wild Flower Planting at Sewage Treatment Plants"; K. A. Keirn, "Demonstration of Care and Operation of Chlorination Equipment."

Following a luncheon the group made an inspection trip of sewage plants in the vicinity of Buffalo, including Tonawanda No. 2, Cheektowaga No. 3, Lackawanna, Blasdell, Woodlawn and Dunkirk.

Although there was no official preconvention trip to Canadian sewage treatment plants, a number of men took in the Hamilton and North Toronto plants.

The ladies' entertainment committee provided a most enjoyable lunch at the Buffalo Consistory on Friday, with a trip to Niagara Falls in the afternoon. On Saturday the ladies enjoyed a sight seeing trip in Buffalo and vicinity.

The next meeting of the Association will be held at Saranac Lake early in October.

The International Association of Public Works Officials

Plans are being completed for the meeting of the International Association of Public Works Officials at the Hotel William Penn in Pittsburgh, Pa., on September 29 and 30 and October 1 next. One of the big features of the meeting is to be an address upon "The Economic Re-Adjustment and Its Relation to the Public Works Official." At the session when this subject is presented, Lester W. Herzog of Albany, N. Y., will be in the chair. He is a past president of the Association and President of the Common Council in Albany. The speakers chosen to handle this important subject are C. A. Dykstra, City Manager of Cincinnati, Ohio, and Robert P. Marsh, Superintendent of Streets and Engineering in Springfield, Mass.

The Association plans this year to give particular attention to the Uniform Street and Sanitation Record System. Advice on handling payrolls and equipment, the purchase and storing of materials and supplies, as well as budgeting and controlling expenses in accordance with the system will be outlined. Among those slated to speak are Alfred E. Roche of Troy, N. Y., John R. Manion of Cincinnati, Ohio, E. E. Chadwick of Winona, Minn.; J. White Guyn of Lexington, Ky., and P. J. Hurtgen of Kenosha, Wis.

Numerous cities are finding it increasingly difficult to dispose of waste material. Dumping places are no longer available or else objections from taxpayers are causing trouble. In an effort to solve their problem, some are considering incinerators and again encountering opposition from uninformed folks. This will be covered by Harrison P. Eddy, consulting engineer of Boston, Mass., who speaks on "Locating an Incinerator and Meeting the Objections of the Taxpayer in a Practical Way."

Three widely known city officials will speak on "Sewer Maintenance and Inlet and Catch-basin Cleaning." These are: Charles I. Palmer, Engineer in Charge of Sewer Construction and Design, Pittsburgh, Pa.; Elwood Johnson, Associate Maintenance Engineer, Washington, D. C., and John S. Flockhart, Assistant Engineer, Bureau of Street Cleaning, Newark, N. J.

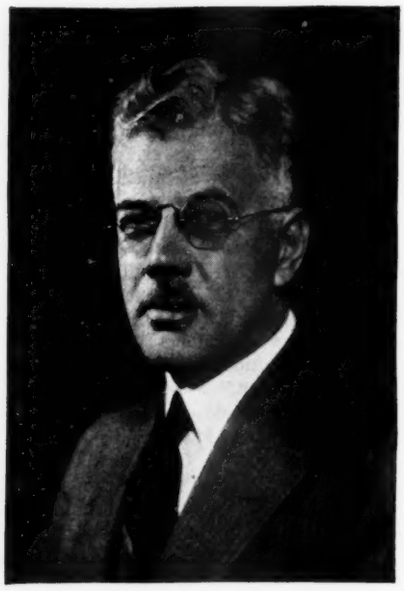
The Conference at Pittsburgh will be staged under the guidance of the following staff of officers: President, H. D. Bradley, Deputy Street Commissioner, Toronto, Canada; first vice-president, Carl Schneider, Mechanical Engineer, Division of Public Works, New Orleans, La.; second vice-president, T. L. Costigan, Superintendent of Street Cleaning, Washington, D. C.; third vice-president, Mark B. Owen, Commissioner of Public Works, Dearborn, Mich.; treasurer, P. J. Hurtgen, Director of Public Works, Kenosha, Wis.

The Board of Governors of the Association includes: Alfred J. Paul, Superintendent of Public Works, Ann Arbor, Mich.; James Garberg, Superintendent of Streets, Minneapolis, Minn.; Dr. M. B. Herlong, City Commissioner, Jacksonville, Fla.; L. E. Dempsey, Superintendent of Sanitation, Greensboro, N. C.; E. A. Wood, Chief of Street Cleaning Division, Winnipeg, Canada; Edwin A. Miller, Supervisor of Maintenance, Rochester, N. Y., and Wilbur H. Winship, Street Commissioner, Indianapolis, Ind.

Personal and Industrial News Items

George B. Sowers, formerly commissioner of engineering of Cleveland, O., has opened an office in the 1900 Euclid Bldg. for the practice of consulting engineering.

Clifford S. Lee, eleven years director of public relations, The Asphalt Institute, has accepted a position with the American Petroleum Institute, 250 Park Ave., New York. He is in the marketing division and among his duties is to counteract through publicity undue increases in gas tax and its use for other than construction and maintenance of highways.



S. F. Beatty, who has been elected president of Austin Manufacturing Co.

John P. Harris, Chemical Engineer and Senior Member of the Technical Staff of the Industrial Chemical Sales Co., Inc., New York, manufacturers of "Aqua" Nuchar, was elected to the office of First Vice President, American Oil Chemists' Society, at the Convention in New Orleans.

Inland Steel Company, Chicago, announces the opening of offices at 1118-19 Fisher Bldg., Detroit, Mich., and the appointment of J. H. Fitch, Jr., as District Sales Manager.

The new Chicago address of McWane Cast Iron Pipe Co. is 333 No. Michigan Ave. The personnel includes Shirley W. Harris, Stanley C. Orr, Dorothy Jackson and Helen O'Connor.

The American Cable Company announces that the Wickwire Spencer Steel Corporation has recently been added to the long list of wire rope manufacturers licensed to manufacture preformed wire rope under the American Cable Company's patents. Other companies in the United States who are lisensed to make preformed wire rope are: American Steel & Wire, Broderick & Bascom Company, E. H. Edwards Company, Hazard Wire Rope Company, Macwhyte Company, Pacific Wire Rope Company, General Cable Corporation and the Wire Rope Manufacturing & Equipment Company.

The Holms-Talcott Company, Inc., with headquarters at Sterling Road, East Hartford, have been appointed FWD dealers for the entire state of Connecticut. The factory-owned branch at New York City, in which the Connecticut territory has been served, will continue to assist the new FWD dealership in its service work.

J. F. Murphy, 2400 Faxon Avenue, Memphis, Tennessee, has recently been appointed a distributor for the Link-Belt line of Shovels-Cranes-Draglines in the Memphis District.

The Chlorine Institute has moved from 30 East 42nd Street to 50 East 41st Street, N. Y.

Walter Holder has been appointed manager of the Boston office of the Barber-Greene Co., Aurora, Ill.

The Peerless-Union Explosives Corporation has been merged with the Atlas Powder Co. of Wilmington, Delaware, and all plants and business are now being handled by the Atlas Co.

Here are some of the new "Caterpillar" Dealers that have been added to the "Caterpillar" Sales Organization:

Western Motors, Ltd., Brandon, Manitoba, Canada. Stouffer Tr. & Eq. Co., Harrisburg, Pennsylvania. Jack Neal Sales Co., San Antonio, Texas. Syracuse Supply Co., Syracuse, New York. Hunter Machinery Co., Milwaukee, & Madison, Wisconsin. John East Iron Works, Ltd., Saskatoon, Sask., Canada. The General Supply Co. of Canada, Ltd., Toronto & Ottawa, Ontario, Canada. Rio Grande Hardware & Machinery Co., Harlingen, Texas. Bert Smith Road Machinery Co., Enid, Oklahoma. Haight Tractor & Equipment Co., Des Moines, Iowa. Georgalina Tractor Co., Augusta, Georgia. Tractors & Equipment, Ltd., Frederickton, N. B., Canada. Grand Forks Tractor & Equipment Co., Grand Forks, N. D. Gleason Motor Car Co., Shamokin, Pennsylvania. Smith Tractor & Equipment Co., Irvington, New Jersey. Flowers Tractor & Equipment Co., Omaha, Nebraska. Cliff Miller Tractor & Equipment Co., Council Bluffs, Iowa. Spring Grove Tractor & Equipment Co., Cincinnati, Ohio. Jarvis-Tull Tractor & Equipment Co., Plainview, Texas. F. Rendon & Hermano, Nuevo Laredo, Tamps, Mexico. Connelly Machinery Co., Billings, Montana. Glendive Tractor & Equipment Co., Sidney & Miles City, Mont. Quincy Tractor Co., Quincy, Illinois. W. T. Walsh Equipment Co., Cleveland, Ohio.

Roy B. Champion, Superintendent of Public Works, Holland, Mich., died recently.

R. D. Mahaffey, vice president and treasurer of the American Wire Works, died on June 3 after an illness of several months. He had been identified with the American Well Works and the pump industry for 43 years.

Explosives for Settling Highway Fills.—Principles and practices which have proved successful in accelerated fill settlement operations are discussed in "Use of Explosives for Settling Highway Fills," a 48-page book just published by the Explosives Department of E. I. du Pont de Nemours & Company, Wilmington, Delaware.

In the main, the subject matter deals with three generally accepted plans of procedure, namely: "The Trench Method," "The Under-Fill Method," and "The Relief Method." But even in the treatment of this trio of methods, no attempt is made to be orthodox or to lay down hard-and-fast rules. Further, "The reader is asked to bear in mind the impossibility of securing complete and detailed information on each and every project where explosives were used for this purpose, and that there may be others not described in this publication, which have been used with every degree of satisfaction."

However, the book is comprehensive within the limits set by the compilers, and the text is supplemented with many diagrams and illustrations made from photographs of actual operations. Also, "Use of Explosives for Settling Highway Fills" is, perhaps, the most complete publication on the subject available. Engineers, contractors and others concerned with highway construction may obtain copies upon application to the du Pont Company.

The State of Pennsylvania, which last year ordered a number of Cleveland tractors, has entered an order for 50 Model "15" Cletracs. The above views show some of the Cletrac-Galion equipment in action in that state.

To Those Who Want The LATEST INFORMATION

any of the following Industrial Literature

WILL BE SENT **FREE** UPON REQUEST

★ *It is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Bituminous Road Paver

25. Specifications and description of new Paver that gathers, proportions, mixes, spreads and compacts bituminous road in one continuous operation offered by Barber-Greene Co., 635 West Park Ave., Aurora, Ill. Ask for Bulletin BPF.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Handling

40. Pouring concrete with portable and permanent belt conveyors on bridges, dams, buildings, locks, sewers, tunnels, etc., is described in a generously illustrated booklet, "CONCRETE HANDLING," by Barber-Greene Co., 635 West Park Ave., Aurora, Ill.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Excavating Buckets

73. Excavating Buckets — shows the various types and sizes, the uses for which they are intended, construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Finishing Machines and Screeds

75. High Speed Screeding and Finishing—the use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages. The Lakewood Engineering Company, Columbus, Ohio.

Graders

76. Latest information about Galion Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Galion Iron Works & Mfg. Co., c-o The Jeffrey Mfg. Co., Columbus, Ohio.

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

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7-32

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

201. Full data on tar and asphalt kettles, oil burning kettles, pouring pots, torches and hand spraying attachments. Connery & Company, Inc., of Philadelphia.

205. The latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay

Combining Superior Strength with Maximum Durability and Resistance to Weather and Storms—

SWEET'S STEEL POSTS

are ideally adapted for your caution or warning signs, highway route markers, street or road intersections signs, etc.

Sweet's Steel Co. *Write for descriptive folder* **Willamsport, Pa.**

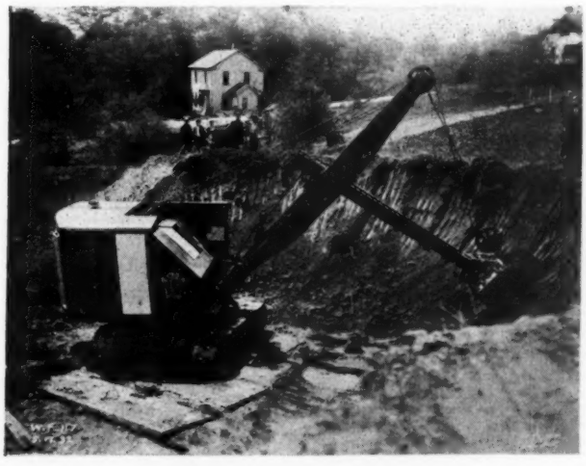
Maintenance and Construction Equipment

Flexibility in a 1 Yd. Power Shovel

The Keystone Driller Company of Beaver Falls, Pennsylvania, has produced a 1-yd. power shovel of exceptional flexibility, which is equally usable as a 1-yd. standard shovel, a 1-yd. skimmer machine, a pullscoop ditching outfit and crane with clamshell. By the use of very large V-type friction wheels in the main drum and planetary gearing, it has been possible to obtain an unusual variability in control of line speed. As a matter of fact, the operator is able to use any line speed from nothing up to 120 ft. per minute for skimmer, standard shovel and pullscoop and 160 ft. per minute for crane operation.

The six types of buckets or utilities, available with the Keystone Model 17, require only three different booms; first, the skimmer-pullscoop 21-ft. double channel boom for operating the heavy, plunger type skimmer bucket and the characteristic line of Keystone pullscoop ditching buckets; second, the standard shovel boom, box girder type, with split 16-ft. dipper sticks; third, the 40 to 50-ft. crane boom, lattice type, special tubular construction.

The machine will operate at any desired slueing speed up to 5¼ rpm.



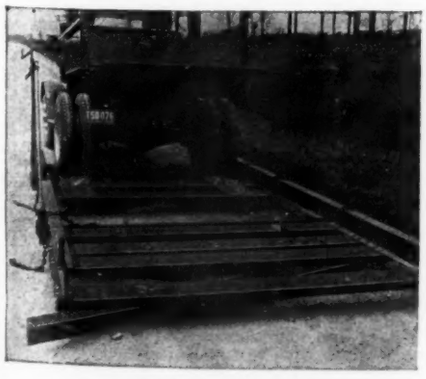
Keystone 1-Yard Power Shovel

Burch Undr-Truk Maintainer

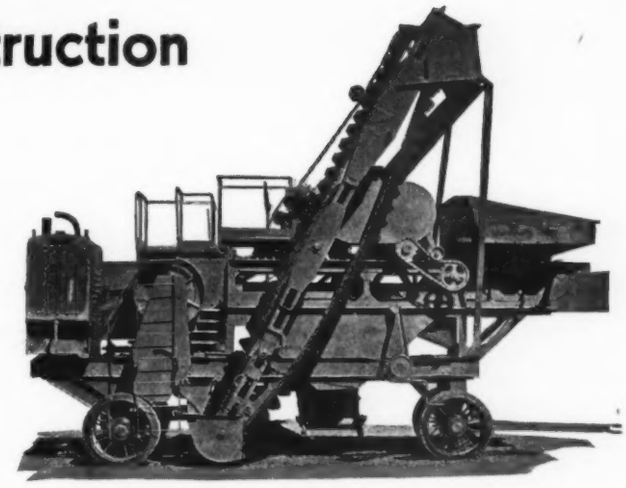
The Burch Corporation, Crestline, Ohio, has announced the Burch Undr-Truk Road Maintainer, which is swung below the truck where it is most easily handled. Any truck may be equipped with the simple fixtures to which the chains are attached, so that the same maintainer unit may be used with any truck.

Blading the material four times at one operation, the seven blades redistribute the surface material evenly and compactly over the road, leaving a smooth, compact surface. Regulation of pitch and of the pressure being applied by the maintainer is simplified by placing the two control levers within easy reach of the driver's seat. Culverts and other obstructions are easily cleared without loss of time.

For the average road, the regular width of the maintainer, extending but little beyond the truck, is sufficient to work the surface thoroughly with one strip in each direction. For wider roads, extension blades are provided.



The Handy Burch Maintainer



Here is a new type of portable Pioneer Gravel Plant, built on the Pioneer "closed cycle" principle, whereby material entering plant goes through a continuous cycle of operations until it is reduced to required specifications. This plant has hopper-type mechanical feeder instead of feeder conveyor. The 75 H. P. Waukesha motor next to crusher operates entire plant. Capacity, 200 to 800 cubic yards per day, depending upon amount of oversize.

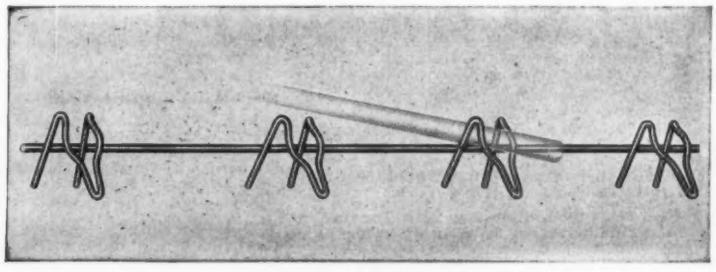
Snap-In Slab and Bridge Girder Bar Spacers

In this continuous slab bar spacer the supporting clips are electrically welded with any desired spacing. The steel setter merely places the continuous strips on the forms and snaps the bars in place. Each bar is rigidly held in place and supported by three legs directly under the bar. There is a minimum amount of steel exposed when the forms are removed as only the points of the legs touch the forms.

Where used on wall work, the strips are nailed to the first form wall erected, and the bars are snapped into the clips. Then the opposite form is erected and the concrete poured in. The bars are rigidly held in place during pouring. The spacers are made to order in lengths not to exceed 10 feet and the clips are welded at any desired spacing. They are made in ½ in., ¾ in., 1 in., 1½ in., and 2 in. heights. The snap-in clips will hold ⅜ in., ½ in., and ⅝ in. bars.

Bridge girder bar spacers are used to support and space bars in large beams and girders. They come in 5-foot strips and are cut to fit the width of the beam or girder on the job.

The spacers are products of the building accessories division of the Union Steel Products Co., Albion, Mich.



Snap-in Slab Spacers

Calcium Chloride, a Natural Dust Layer,'" 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. Complete data for selecting the proper size snow plow for your particular make and model of truck. Carl H. Frink, Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Incinerators

396. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa. Booklet on request.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. "Data Book"—Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

407. New "Handbook of deLavaud Centrifugally Cast Iron Pipe" contains useful information for the water works man including revised specifications together with dimensions and weights of deLavaud pipe in accordance with Federal Specifications for Pipe; Water, Cast-Iron (Bell and Spigot) N. WW-P-421. Just issued by the U. S. Pipe and Foundry Co., Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Sludge Treatment

430. Downes Floating Covers and Sludge Digestion Equipment. The Pacific Flush Tank Co., 136 Liberty St., New York, N. Y. Contains photographs of installations of floating covers and technical data on the subject.

Treatment

432. Eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. The Pacific Flush Tank Company of Chicago and New York.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Valves

436. Data Book on Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

Water Storage

442. "Modern Water Storage" contains 28 pages of reliable information, interesting photographs, authentic engineering data and "Pittsburgh-Des Moines" specifications on various types of elevated tanks, penstocks, pipe lines, stand pipes, steel reservoirs, treating plants and complete water systems.

Developments in Water and Sewerage Equipment

The Dorrco Flocculator

The Dorrco Flocculator, developed in collaboration with M. C. Smith, and introduced in the municipal and industrial water treatment fields by The Dorr Company, Inc., is adapted equally well to the requirements of water softening and coagulation and may be installed in existing sedimentation tanks as well as in new ones.

In existing plants, using a number of rectangular sedimentation tanks, the flocculators are installed transversely across the tanks, close to the influent end. Where the plant is a new one or where mechanical clarifiers are to be used, the flocculators may best be installed in separate tanks, close or adjacent to the clarifier tank.

The Dorrco Flocculator consists of a number of paddle wheel assemblies mounted on and rotating with a steel shaft in the tank. The paddle blades are paraffined wood, attached to the ends of radial steel arms, and are supplemented by diagonal blades to prevent the formation of dead or quiescent zones around the shaft. Except at very small plants a number of flocculators are used, the shafts being arranged parallel to one another and with the water that is being chemically treated passing by them in series. The paddle blades of multiple units of this type are so arranged as to provide a progressive diminution in the intensity of agitation as the water passes through the unit. Thus the treated water is given, first, a relatively rapid mixing for the dispersion of reagents and, second, a progressively milder agitation to promote flocculation and the growth of these flocs to uniform agglomerations of greater size. This feature is distinctive and is known as tapered or decelerated flocculation.

Practice at many water softening and coagulating plants has shown that the proper return of settled sludge to the influent is decidedly beneficial, first because it reduces the chemicals actually required for a given result, and second, because it increases the rate of flocculation and sedimentation. The improved flocculation and sedimentation is attributed to the providing of additional nuclei for the formation of flocs and the entrainment of colloids. The reduction in chemical consumption is believed to be due to a catalytic acceleration of the reaction, or, more probably, to a reduction in supersaturation, either or both of which result in a more complete utilization of the reagents. Just such a continuous recirculation of flocs and sludge is an inherent feature of this flocculator, but the unique feature of this machine is the accomplishing of this objective without destroying or damaging the floc structure.

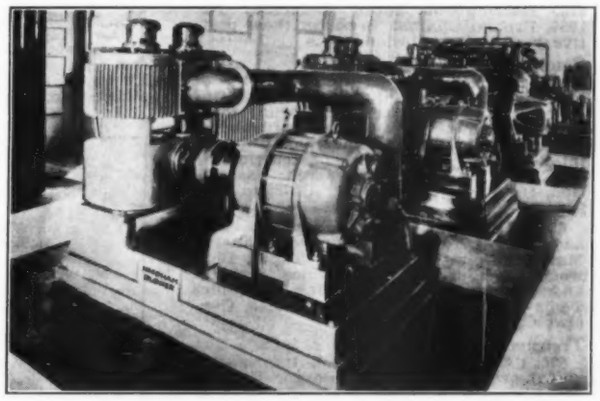
The Dorrco Flocculator is offered in the simplex type, one row of paddles in a single tank; duplex type, two rows of paddles in a single tank; and multiple type, three or more rows of paddles either in a single tank or in the feed end of a sedimentation basin. Two installations have been made—four multiplex units at Richmond, Va., and eight duplex units, not yet in operation, at Hamilton, Ont.

The installation at the Richmond, Va., waterworks consists of four quadruplex flocculators, consisting of four rows each of paddles 8′-9″ in diameter and 63′-9″ long, installed in the influent ends of four settling basins 150′ long.

During a four-months period of continuous operation, the chemical dosage applied for coagulating this turbid water was reduced to the extent of one grain of alum per gallon, thus effecting a reagent saving of $1400 per month. The settled water going to the sand filters was as good as the former filter effluent, resulting in an improvement in the quality of water finally pumped to the mains and an increase in the capacity of the filter plant of 25-35%.

Positive Pressure Blowers for Sewage Treatment

The Needham blower, manufactured by the Pneumatic Tube Supply Co., Plainfield, N. J., produces pressures up to 10 pounds and is particularly adapted for activated sludge sewage treatment. These blowers are made in sizes 4½x7-inch, 60 cu. ft. of free air per minute up. Further information on details of design and on the advantages of the worm driven impeller type blowers will be sent on request. Three of these blowers have been installed in the Morristown, N. J., treatment plant.

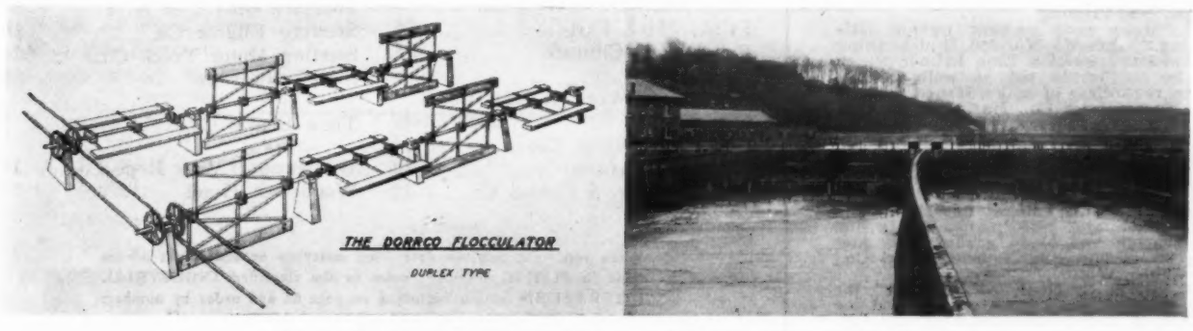


Three Needham Blowers in Morristown, N. J., plant deliver air for activated sludge treatment.

6-Cylinder Diesel for Pumping and Lights

A six cylinder Diesel engine of 175-200 hp. with 7¾″ x 8½″ bore and stroke has recently been put on the market by the Waukesha Motor Company, Waukesha, Wisconsin.

This Diesel Model 6DLK, is designed primarily for stationary and semi-portable work. It is suitable for temporary installations such as are common in construction work where large air compressors, central mixing plants, pumping stations and similar operations must be carried on. It is especially suited to small municipal pumping and lighting plants as a permanent prime mover. The design is very simple, comprising the fewest possible number of parts and completely automatic control by a highly responsive governor providing extremely close regulation.



View of the Dorrco Flocculator, and of the Richmond, Va., installation.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., Peoria, Ill.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125. Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules, General Catalog No. 11.

Transits and Levels

629. A booklet giving full information on the sizes and styles of Berger Transits and Levels will be sent promptly by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co. 136 No. 12th St. Philadelphia, Pa.

Wire Rope

634. Williamsport Wire Rope Co., Chicago, Ill., has issued a folder illustrating their new method of "preseating."

LATEST PUBLICATIONS

Following are among the latest publications received and have not been described in this section before.

Explosives

74. "Use of Explosives for Settling Highway Fills." A new booklet which fully explains by diagrams and charts the three methods developed after many tests by the Du Pont engineers, which singly or in combination will quickly and efficiently do your job. Just issued by E. I. Du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.

Dust Control

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n., National Press Building, Washington, D. C.

Pumps, Self-Priming

416. "Make your present pumps self-priming." Bulletin No. 530 B describing the Hazleton Suction Line Primer which can be applied to old as well as new pumps regardless of make. Issued by Barrett, Haentjens & Co., Hazleton, Pa.

Road Machinery

743. Comparative specifications of the Caterpillar line of road machinery. A folder issued by Caterpillar Tractor Co., Peoria, Ill.

744. Three new folders describing the construction and performance of its line of elevating and blade graders has just been issued by Allis-Chalmers Mfg. Co., Milwaukee, Wis.

745. "G. S. C. Hi-Speed Spreader" for road building, road maintenance and ice control. A new folder issued by Efficient Road Machinery, Inc., 527 So. Warren St., Syracuse, N. Y.

746. "The Gledhill Road Adjustor," an 8-page illustrated bulletin describes a new development in road adjusting equipment. Gledhill Road Machinery Co., Galion, Ohio.

747. "The Telsmith Cone Crusher," a new bulletin containing full description and specifications of their cone crusher, issued by Smith Engineering Works, Milwaukee, Wis.

Road Materials

748. "Fool-Proof Roads" a reprint presenting ideas in safety which enter into the design and construction of modern highways. Distributed by the Asphalt Institute, 801 2nd Ave., New York, N. Y.

749. A new folder describing Inland 4-Way Floor Plate is ready for distribution by the Inland Steel Co., 1st Nat'l Bank Bldg., Chicago, Ill.

Miscellaneous Equipment

750. "Repair Shop Lathes," a booklet describing a new line of low-priced lathes for highway depts., contractors and engineers. Issued by South Bend Lathe Works, So. Bend, Ind.

751. "The Ellsco Superheater for Power Plants," a 52 page illustrated catalog issued by the Superheater Co., 60 E. 42nd St., New York, N. Y.

752. "Frost-proof Clark Meter boxes," a new folder issued by H. W. Clark Co., Mattoon, Ill.

753. Net prices of the improved line of Beaver Pipe Tools—a folder just issued by The Borden Company, Warren, Ohio.

754. A new series of bulletins describing their well drill are available from Keystone Driller Co., Beaver Falls, Pa.

755. "Lukenweld Construction — the modern method of manufacturing parts for machinery and equipment." A new booklet just published by Lukenweld, Inc., Coatesville, Pa.

756. "Inland steel sheet piling." A folder just issued by the Inland Steel Co., Chicago, Ill.

757. A catalog of blades for road grader replacements. Issued by Shunk Mfg. Co., Bucyrus, Ohio.

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